References

1. Ahart, J.R. 1995. Tomorrow's HVAC engineer. *Heating/Piping/Air Conditioning*. January, pp 155-162.

2. American Society for Heating, Refrigeration and Air Conditioning Engineers. 1992. *ASHRAE Handbook*. American Society for Heating, Refrigeration and Air Conditioning Engineers, Inc.

3. Arkin, H. & Paciuk, M. 1997. Evaluating intelligent building according to level of service systems integration. *Automation in Construction*, Sep. Vol: 6, Part: 5-6, pp 471-479.

4. Arockiasamy, M. 1993. *EXPERT SYSTEMS Applications for Structural, Transportation, and Environmental Engineering*. Boca Raton, Florida: CRC Press, Inc.

5. Barat, J. 1991. Energy audits. *The Construction Specifier*, October, pp. 100-101.

6. Blaine, D.C. 1993. SBS: The symptom of incorrect focus by architects and engineers. *S. A. Refrigeration and Airconditioning*, November, pp. 29-31.

7. Boody, H.J. 1997. Total system approach saves energy. *ASHRAE Journal*. November, pp 52-54.

8. Box, G.E.P., Hunter, W.G. & Hunter, J.S. 1978. *Statistics for Experimenters*. USA, John Wiley & Sons, Inc.

9. Brightman, R.W., Luskin, B.J. & Tilton, T. 1971. *Data Processing for Decision-Making*. Second Edition. New York, The Macmillan Company.

10. Brown, W.K. 1996. Application of evaporative cooling to large HVAC systems. *ASHRAE Transactions: Symposia*, pp 895-907.

11. Carrier Air Conditioning Company, 1965. *Handbook of Air Conditioning System Design*. USA, McGraw-Hill, Inc.

12. Cerami, V.J. 1996. HVAC equipment and noise. *Heating/Piping/Air Conditioning*. March, pp 49-60.

13. Claassen, C.J. 1998. A decision-making model for selecting an air cooling or airconditioning system. *Refrigeration and Airconditioning*, May, pp 51-52.

14. Claassen, N. 1995. Developments in multi-stage evaporative cooling. *S. A. Refrigeration and Airconditioning*, March, pp. 55-67.

15. Clark, G.& Metha P. 1997. Artificial intelligence and networking in integrated building management systems. *Automation in Construction*, September, Vol: 6, Part: 5-6, pp 481-498.

16. Clarke, J.A. & Maver, T.W. 1991. Advanced design tools for energy conscious building design: development and dissemination. *Building and Environment,* Vol. 26, No. 1, pp 25-34.

17. Consulting Specifying Engineer, 1993. Sustainable design in the '90s. *Consulting-Specifying Engineer.* Mid-September, pp 10-13.

18. Department of the Environment (UK). 1993 Good practice guide 71. *Energy Efficiency Office.* January, pp. 1-6.

19. Gupta, R.P. 1997. HVAC for commercial office buildings. *Heating/Piping/Air Conditioning.* March, pp 53-59.

20. Institute of Industrial Engineers. 1987. *Simulation.* USA, Industrial Engineering and Management Press.

21. Instrument Society of America. 1989. *Artificial Intelligence Handbook.* Volume One Principles, USA, Instrument Society of America.

22. Landman, W.J. 1995. Linking HVAC system design and operation through integrated controls. *ASHRAE Journal.* December, pp 29-33.

23. Linford, R.G. 1996. HVAC retrofitting and remodeling. *Heating/Piping/Air Conditioning.* March, pp 39-45.

24. Linford, R.G. 1997. HVAC retrofit evaluations: persuading owners to do it right. *Heating/Piping/Air Conditioning.* November, pp 77-81.

25. Marther, A., Mazzuchetti, G. & Edwards, W. 1994. Quality and reliability in consulting engineering. *Electricity and Control.* June, pp. 18-19.

26. Mathews, E.H. 1986. Thermal analysis of naturally ventilated buildings. *Building and Environment,* Vol. 21, No. 1, pp 35-39.

27. Mathews, E.H.,Van Heerden, E. & Arndt D.C. 1999. A tool for integrated HVAC, building energy and control analysis Part 1: overview of QUICK control. *Building and Environment,* Vol. 34, pp 429-449.

28. McQuiston, F.C. & Parker, J.D. 1988. *Heating, Ventilating, and Air Conditioning.* Canada, John Wiley & Sons, Inc.

29. Mitchell, J 1997. Simulation or experimentation for HVAC Systems? *HVAC&R Research*, January, Vol: 3, No. 1, pp 1-2.

30. Parks, R.L. 1996. The basics of industrial ventilation design. *ASHRAE Journal.* November, pp 29-34.

31. Pannkoke, T. 1996. Industrial HVAC. A survey of design considerations. *Heating/Piping/Air Conditioning*. November, pp 61-71.

32. Rizzi, E.A. 1980. *Design, and Estimating for Heating, Ventilating, and Air Conditioning.* New York, Van Nostrand Reinhold Company.

33. Rousseau, P.G. & Mathews, E.H. 1993. Needs and trends in integrated building and HVAC thermal design tools. *Building Environment*. Vol. 28, No. 4, pp. 439-452.

34. Said, S.A. & Alnajjar, R.K. 1993. Selection of an air-conditioning system for a hospital. *Energy Engineering.* Vol. 90, No. 3, pp. 24-34.

35. Shams, H., Nelson, R.M., Maxwell, G.M. & Leonard, C. 1995. Development of a knowledge-base system for HVAC type selection. *ASHRAE Journal.* August, pp 165-172.

36. Silverman, B.G. 1987. *Expert Systems for Business*. USA, Addison-Wesley Publishing Company, Inc.

37. Smith, W.W. 1996. Impacts of computer technology on the 1996 HVAC industry. *Heating/Piping/Air Conditioning*. January, pp 83-84.

38. TEMMI. New Quick, P.O. Box 13517, Hatfield, 0028, South Africa.

39. Tinsley, R.W. 1997. Altitude considerations in HVAC equipment selection. *Heating/Piping/Air Conditioning*. August, pp 67-73.

40. Todesco, G. 1997. Super-efficient buildings: how low can you go? *Refrigeration and Airconditioning.* May, pp. 43-53.

41. Tseng, P.C., Harmon, J. & Edwards, F.C. 1993. Commissioning and Construction Quality Control - a new Perspective on facility Commissioning. *ASHRAE Transactions: Symposia.* Vol. 99, part 2, pp. 959-969.

42. Van Heerden, E. & Mathews, E.H. 1996. A new simulation model for passive and low energy architecture. *Building & Urban Renewal*. July, pp. 223-228.

43. Wheeler, A.E. 1997. The V in classroom HVAC. *ASHRAE Journal.* October, pp 50-55.

44. Wolfgram, D.D., Dear, T.J. & Galbraith, C.S. 1987. *Expert Systems for the Technical Professional.* Canada, John Wiley & Sons, Inc.

Appendix A: Knowledge Base

The detail of the knowledge base will be discussed in this appendix. The detail decision tree is shown in Figure 1. Each question in this tree is discussed using the following format:

Question index : The question ID number as used in the decision tree. See Figure 1
Previous question : List of questions calling this question

Question : The question

Purpose of question : The reason behind the question

Result parameters : Give the possible answers

Result of question : For one of the above results the following is true:

- Knowledge gained : Knowledge gained from this answer to the question
- Recommended systems : Systems that can be recommended with the knowledge gained
- Systems not recommended : Systems that cannot be recommended with the knowledge gained
- Action : Action that must be taken now
- Next question : The next question that must be called

Result of question : For the other results the following is true:

- Knowledge gained : Knowledge gained from this answer to the question
- Recommended systems : Systems that can be recommended with the knowledge gained
- Systems not recommended : Systems that cannot be recommended with the knowledge gained
- Action : Action that must be taken now
- Next question : The next question that must be called

The questions will be discussed in an alphabetical order.

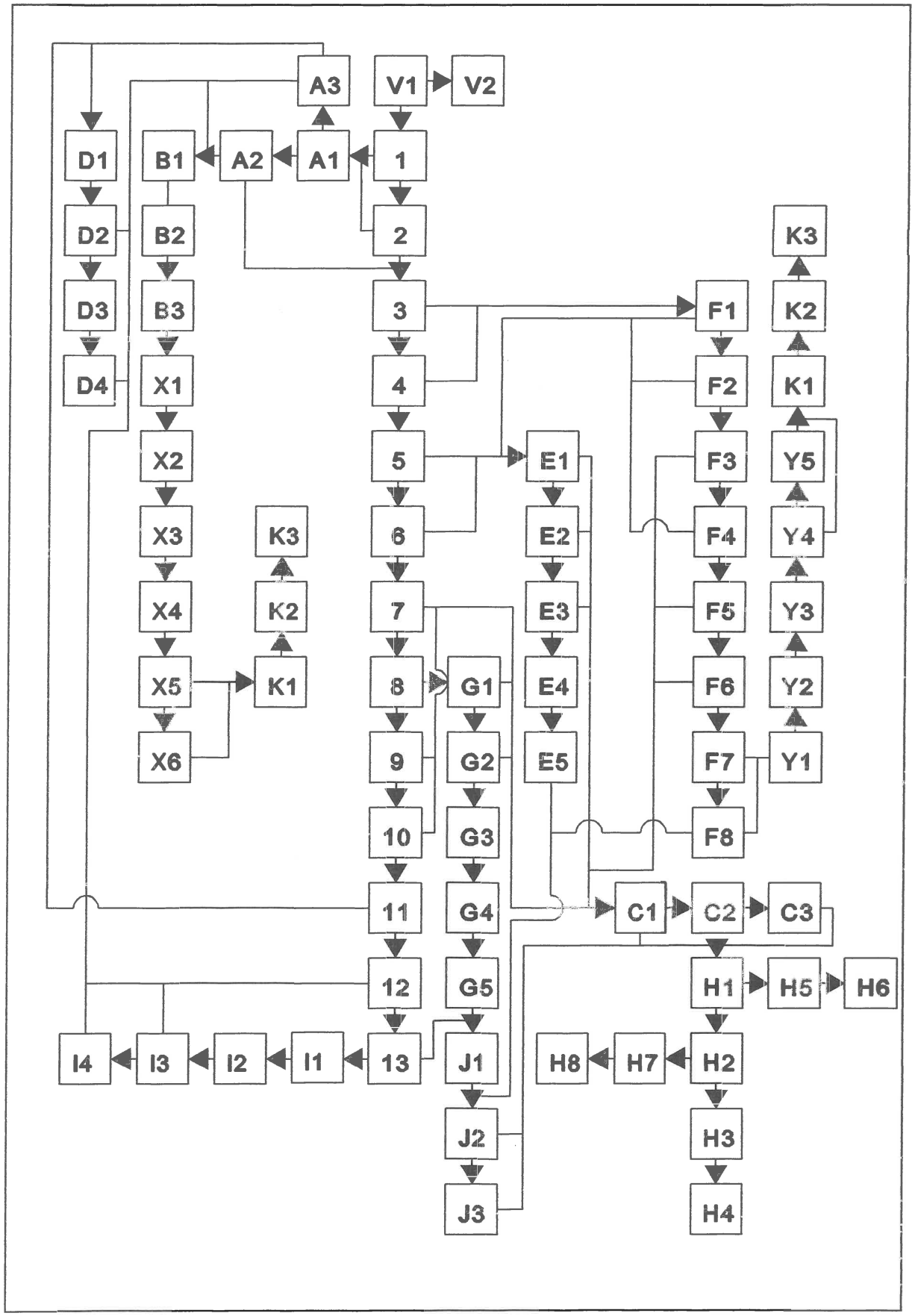

Figure 1 Detail decision tree

Main Question Group

Question index : 1
Previous question : V1

Question : Is the system for a new building or for a retrofit?

Purpose of question : There may be space limitations for the installation of ducting and cooling equipment in a retrofit. Space can be allocated for an HVAC system in a new building. Space is an important system selection parameter because some systems require ducting and central equipment rooms.

Result parameters : New building/Retrofit

Result of question : New building

Knowledge gained	: Space can be allocated for ducting and cooling equipment
Recommended systems	: Any system
Systems not recommended	: None
Action	: Determine if the design of the building facilitates the installation of an HVAC system
Next question	: **2**

Result of question : Retrofit

Knowledge gained	: There may be possible space limitations for the installation of ducting and cooling equipment
Recommended systems	: Any system
Systems not recommended	: None
Action	: Get more information about space for ducting
Next question	: **A1**

Question index : 2
Previous question : 1

Question : Is there space for the installation of ducts and an equipment room in the building?

Purpose of question : The design of the new building may not incorporate space for the installation of ducting and cooling equipment. This is an important parameter because some systems require ducting and central equipment rooms.

Knowledge gained in the previous questions:

- The building is a new building

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is space for an HVAC system in the building
Recommended systems	: Any system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **3**

Result of question : No

Knowledge gained	: Space was not allocated for the installation for HVAC equipment
Recommended systems	: A system with small space requirements
Systems not recommended	: A system with large space requirements
Action	: Get more information about space for ducting
Next question	: **A1**

Question index : 3
Previous question : 2/A2

Question : Are large volumes of fresh air required in the zone?

Purpose of question : Large volumes of fresh air are needed in zones where odours are a problem. Examples of such zones are lobbies, restaurants, toilets and any zone that is occupied by smokers. Large volumes of fresh air are also needed where a large number of people get together in confined spaces. Examples of such zones are theatres, banks and other public places.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There is no space limitation

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Large volumes of fresh air are required
Recommended systems : A system that supplies fresh air to the zone:
- Package units
- Air-water systems
- All air systems
- Evaporative cooling systems

Systems not recommended : Any system that just recirculate the air in the zone :
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **F1**

Result of question : No

Knowledge gained : Large volumes of fresh air are not required
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **4**

Question index : 4
Previous question : 3

Question : Must the system provide positive or negative pressures in the zone?

Purpose of question : Positive or negative pressures are required in certain applications. It is preferable to have positive pressure in computer rooms and other zones where dust entering the zone is undesirable. The positive pressure will ensure that infiltration will be from the inside of the zone. This prevents unfiltered air from entering the zone. In laboratories working with hazardous material it is preferable to have negative pressure in the zone. This prevents any hazardous gases from leaving the building through infiltration points. Laboratories usually have scrubbers in their exhaust system.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Positive or negative pressure is required
Recommended systems : Systems that supply air to the zone:
- Package units
- Air-water systems
- All air systems
- Evaporative cooling systems

Systems not recommended : Any system that only recirculate the air in the zone
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems

Action : Proceed with questioning to determine system that meets these requirements.
Next question : **F1**

Result of question : No

Knowledge gained : Positive or negative pressure is not required
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **5**

Question index : 5
Previous question : 4

Question : Is dust a problem in the area?

Purpose of question : It is preferable to have a central filtration system in areas where dust is a problem. This has the advantage that only one set of filters has to be cleaned regularly. Typical problem areas are offices close to foundries and open cast mines.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh are is not required in the zone
- Positive or negative pressure is not required

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Dust is a problem in the area
Recommended systems : Any system with a centralised filtration system:
- Package units
- All air systems
- Air-water systems

Systems not recommended : Any system that does not have a centralised filtration system:
- Window-mounted units
- Wall-mounted units
- Split units
- Air-water systems
- Evaporative cooling systems

Action : Proceed with questioning to determine a system that meets these requirements
Next question : **E1**

Result of question : No

Knowledge gained : Dust is not a problem
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : 6

Question index : 6
Previous question : 5

Question : Is noise control very important?

Purpose of question : It is preferable that noise be kept as low as possible. Low-noise cooling systems are better for office buildings and theatres but usually a lot more expensive. Systems with cooling equipment in the zone are noisier than the other types of systems.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Noise control is very important
Recommended systems : Systems that have centralised cooling equipment:
- Package units
- All air systems
- Air-water systems

Systems not recommended : Any system with cooling equipment in the zone:
- Window-mounted units
- Wall-mounted units
- Split units
- Air-water system
- Evaporative cooling systems

Action : Proceed with questioning
Next question : **E1**

Result of question : No

Knowledge gained : Noise control is not very important
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **7**

Question index : 7
Previous question : 6

Question : Are there very stringent Rh requirements in the zones?

Purpose of question : It is preferable to control the Rh because it affects the air quality of the air. Humidifiers and dehumidifiers are necessary to accomplish this. The added cost of these components is not always justified when the cooling load required is small.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There is no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There are stringent Rh requirements.
Recommended systems : Systems that have centralised cooling equipment:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems
- Evaporative cooling systems
- Air-water systems

Action : Proceed with questioning
Next question : **C1**

Result of question : No

Knowledge gained : Stringent Rh control is not required
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **8**

Question index : 8
Previous question : 7

Question : Is cooling equipment allowed on the outside of the building (walls, windows or roof)?

Purpose of question : Cooling systems installed in windows or on walls may not be very aesthetically pleasing.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Equipment is allowed on the outside of the building
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **9**

Result of question : No

Knowledge gained : Equipment is not allowed on the outside
Recommended systems : Systems that have centralised cooling equipment:

- Package units
- All air systems
- Air-water systems
- All water systems

Systems not recommended : Any system with cooling equipment on the outside:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Action : Proceed with questioning
Next question : **G1**

Question index : 9
Previous question : 8

Question : Is cooling equipment acceptable in occupied zones?

Purpose of question : It is sometimes preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Cooling equipment may also be aesthetically undesirable in the cooling zone. Generally this however should not be a problem.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Cooling equipment is allowed in the zones
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **10**

Result of question : No

Knowledge gained : No cooling equipment is allowed in the zone
Recommended systems : Systems that do not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems
- Air-water systems
- Evaporative cooling systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : 10
Previous question : 9

Question : Is maintenance acceptable in occupied zones?

Purpose of question : It is sometimes preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Generally though, this should not be a problem.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Maintenance is allowed in the zones
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **11**

Result of question : No

Knowledge gained : No maintenance is allowed in the zone
Recommended systems : Systems that do not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems
- Air-water systems
- Evaporative cooling systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : 11
Previous question : 10

Question : Is it important to cut off the supply to unoccupied zones?

Purpose of question : To cut off the supply to an unoccupied zone may be required in office buildings that are rented out. The easiest method is to supply an HVAC system for each of the zones. This leads to high initial cost. There are only a few systems with the possibility of cutting off the supply to unoccupied zones.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building.
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is important to to be able to cut off the supply to unoccupied zones

Recommended systems : Systems that have separate units for each zone:

- Window-mounted units
- Wall-mounted units
- Split units
- All water systems
- Evaporative cooling systems

Systems not recommended : Any system with a central unit supplying all the zones with cooled air. It is impractical to cut off the air supply because of the expensive installation, difficult maintenance and balancing of the air supply system

- Package units
- All air systems
- Air-water systems

Action : Proceed with questioning

Next question : **D1**

Result of question : No

Knowledge gained	: It is not important to cut the supply to unoccupied zones
Recommended systems	: Any system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **12**

Question index : 12
Previous question : 11

Question : Is separate zone electrical billing necessary ?

Purpose of question : Separate zone electrical billing for the HVAC system may be required in office buildings that are rented out. Only a limited number of systems of the same family make it possible to give separate electrical billing.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to unoccupied zones

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Separate electrical billing is required
Recommended systems : Systems that have separate units for each zone:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Systems not recommended : Any system with a central unit supplying all the zones:

- Air-water systems
- All air systems
- All water systems
- Package units

Action : Proceed with questioning
Next question : **B1**

Result of question : No

Knowledge gained : Separate electrical billing is not required
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **13**

Question index : 13
Previous question : 12

Question : Is a large cooling load needed?

Purpose of question : It is necessary to determine the size of the load because this has an effect on the type of system that is needed.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There is no space limitation
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to unoccupied zone
- Separate electrical billing is not required

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : A large cooling load is required
Recommended systems : A system with a central unit supplying all the zones:

- Air-water systems
- All air systems
- All water systems

Action : Proceed with questioning
Next question : **J1**

Result of question : No

Knowledge gained : A large cooling load is not required
Recommended systems : A system that has separate units for each zone:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling system
- Package unit

Action : Proceed with questioning
Next question : **I1**

Question Group A

Question index : A1
Previous question : 1/2

Question : Is there space for the installation of ducting?

Purpose of question : Several systems cannot be used if there is no space for the installation of ducts.

Knowledge gained in the previous questions
- The system is for a new or retrofit building
- There are space limitations(2)

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There is space for ducts
Recommended systems : Any
Systems not recommended : None
Action : Proceed with questioning
Next question : **A2**

Result of question : No

Knowledge gained : There is no space for ducts
Recommended systems : Any system that does not need space for ducts:
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems
- Evaporative cooling systems

Systems not recommended : Systems that use ducts:
- Package units
- All air systems
- Air-water systems

Action : Proceed with questioning
Next question : **A3**

Question index : A2
Previous question : A1

Question : Is there room in the building, on the roof or outside for cooling equipment?

Purpose of question : Several systems need space for cooling equipment in the building or on the roof.

Knowledge gained in the previous questions
- The system is for a new or retrofit building
- There are space limitations(2)
- There is space for ducts in the building

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There is space for cooling equipment
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **3**

Result of question : No

Knowledge gained : There is no space for cooling equipment
Recommended systems : Any system that does not need space for cooling equipment in a special room or on the roof:
- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Systems not recommended : Systems that needs space:
- Package units
- All air systems
- Air-water systems
- All water systems

Action : Proceed with questioning
Next question : **B1**

Question index : A3
Previous question : A1

Question : Is there room for cooling equipment in the building, on the roof or the outside of the building?

Purpose of question on : A number of systems need space for cooling equipment in the building or the roof.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There are space limitations(2)
- There is no space for ducts in the building
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - All water systems
  - Package units
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There is space for cooling equipment
Recommended systems : Any of the following:
- Window-mounted units
- Wall-mounted units
- Split units
- All water systems
- Evaporative cooling systems

Systems not recommended : None
Action : Proceed with questioning
Next question : **D1**

Result of question : No

Knowledge gained : There is no space for cooling equipment
Recommended systems : Any of the following:
- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Systems not recommended : None of the following:
- All water systems

Action : Proceed with questioning
Next question : **B1**

Question Group B

Question index : B1
Previous question : 12/A2/A3/D2/D4/I3/I4

Question : Are there non-perimeter zones in building that have to be cooled?

Purpose of question : Wall and window units cannot be used to cool non-perimeter zones.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There is not space for an equipment room
- There is not space for ducts in the building(A2)
- There is space for ducts(A3)
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There are internal zones to cool
Recommended systems : Split units
Systems not recommended : None of the following:
- Window-mounted units
- Wall-mounted units
- Evaporative cooling systems

Action : End of questioning
Next question : **End**

Result of question : No

Knowledge gained : There are no internal zones that need to be cooled.
Recommended systems : Any of the above systems
Systems not recommended : None of the above
Action : Proceed with questioning
Next question : **B2**

Question index : B2
Previous question : B1

Question : Can and may cooling equipment be installed in a window or through a wall?

Purpose of question : Window-mounted and wall-mounted units are not very aesthetically pleasing.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is not space for an equipment room
- There is space for ducts(A3)
- There is not space for ducts in the building(A2)
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Cooling units are allowed in the windows
Recommended systems : Any of the above systems
Systems not recommended : None of the above
Action : Proceed with questioning
Next question : **B3**

Result of question : No

Knowledge gained : Cooling units are not allowed in windows
Recommended systems : Split units
Systems not recommended : None of the following:
- Window-mounted units
- Wall-mounted units
- Evaporative cooling systems

Action : End of questioning
Next question : **End**

Question index : B3
Previous question : B2

Question : Should the cooling equipment be aesthetically pleasing?

Purpose of question : Window-mounted and wall-mounted units are not very aesthetically pleasing.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is not space for an equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is not space for ducts in the building(A2)
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Cooling units must be aesthetically pleasing
Recommended systems : Split units
Systems not recommended : None of the following:
- Window-mounted units
- Wall-mounted units
- Evaporative cooling systems

Action : End of questioning
Next question : **End**

Result of question : No

Knowledge gained : Cooling units do not have to be aesthetically pleasing
Recommended systems : Any of the above systems
Systems not recommended : None of the above
Action : Proceed with questioning
Next question : **X1**

Question Group C

Question index : C1
Previous question : 7/9/10/E1/E2/E3/F3/F5/F6/G1/G2

Question : Is a large cooling load necessary?

Purpose of question : Of the systems available it is preferable to install an all air system if a large cooling load is necessary.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is a very important consideration
- Stringent Rh control is necessary(7)
- Cooling equipment is not allowed on the outside of the building(8)
- Cooling equipment is not allowed in the occupied zone(9)
- Maintenance is not allowed in the occupied area
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : A large load is needed
Recommended systems : All air systems
Systems not recommended : Package units
Action : Proceed with questioning
Next question : **H1**

Result of question : No

Knowledge gained : A large load is not needed
Recommended systems : Any system
Systems not recommended : None
Action : Proceed with questioning
Next question : **C2**

Question index : C2
Previous question : C1

Question : Is the building a small low-rise building?

Purpose of question : Of the systems available it is preferable to install a package system in a small low-rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is a very important consideration
- Stringent Rh control is necessary(7)
- Cooling equipment is not allowed on the outside of the building(8)
- Cooling equipment is not allowed in the occupied zone(9)
- Maintenance is not allowed in the occupied area
- A large cooling load is not necessary
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: It is a small low-rise building
Recommended systems	: Package units
Systems not recommended	: All air systems
Action	: Proceed with questioning
Next question	: **P1**

Result of question : No

Knowledge gained	: The building is not a small low-rise building
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **C3**

Question index : C3
Previous question : C2

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is a very important consideration
- Stringent Rh control is necessary(7)
- Cooling equipment is not allowed on the outside of the building(8)
- Cooling equipment is not allowed in the occupied zone(9)
- Maintenance is not allowed in the occupied area
- The building is not a small low rise building
- A large cooling load is not necessary
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained : System with a low initial cost is preferable
Recommended systems : Package systems
Systems not recommended : All air systems
Action : Proceed with questioning
Next question : **P1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : All air systems
Systems not recommended : Package units
Action : Proceed with questioning
Next question : **H1**

Question Group D

Question index : D1
Previous question : 11/A3

Question : Is the building a large, medium or high-rise building?

Purpose of question : Of the systems available it is preferable to install an all water system in a large, medium or high rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There is no space for ducts
- There is space for an equipment room
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - All water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : The building is a large building
Recommended systems : All water systems
Systems not recommended : Any of following systems:

- Window-mounted units
- Wall-mounted units
- Split units

Action : Proceed with questioning
Next question : **P3**

Result of question : No

Knowledge gained : The building is not large
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **D2**

Question index : D2
Previous question : D1

Question : Is the building a small low-rise building?

Purpose of question : Of the systems available it is preferable to install a unitary system in a small low-rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There is no space for ducts
- There is space for an equipment room
- The building is not a large, medium or high-rise building
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - All water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is a small low-rise building
Recommended systems : Any of following systems:
- Window-mounted units
- Wall-mounted units
- Split units

Systems not recommended : All water systems
Action : Proceed with questioning
Next question : **B1**

Result of question : No

Knowledge gained : The building is not a small low-rise building
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **D3**

Question index : D3
Previous question : D2

Question : Is cooling equipment allowed on the outside of the building (walls, windows or roof)?

Purpose of question : Cooling systems installed in windows or on walls may not be very aesthetically pleasing.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There is no space for ducts.
- There is space for an equipment room
- The building is not a large, medium or high-rise building
- The building is not a small low-rise building
- Any of the following systems meet the requirements of the previous questions:
  - Window mounted units
  - Wall mounted units
  - Split units
  - All water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Equipment is allowed on the outside
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **D4**

Result of question : No

Knowledge gained : Equipment is not allowed on the outside of the building
Recommended systems : Systems with centralised cooling equipment:
  - All water systems

Systems not recommended : Any system with cooling equipment on the outside:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative cooling systems

Action : An all water system is selected
Next question : **P3**

Question index : D4
Previous question : D3

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There is not space for ducts
- There is space for an equipment room
- The building is not a large, medium or high-rise building
- The building is not a small low rise-building
- Cooling equipment is allowed on the outside of the building
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - All water systems

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained : Systems with a low initial cost are preferable
Recommended systems : Unitary systems usually have low initial costs:
- Window-mounted units
- Wall-mounted units
- Split units

Systems not recommended : All water systems
Action : Proceed with questioning
Next question : **B1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable.
Recommended systems : All water systems
Systems not recommended : Unitary systems:
- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Action : An all water system is selected
Next question : **P3**

Question Group E

Question index : E1
Previous question : 5/6/F1/F2/F4

Question : Are there very stringent Rh requirements in the zones?

Purpose of question : It is preferable to control the Rh because it affects the air quality of the air. Humidifiers and dehumidifiers are necessary to accomplish this. The added cost of these components is not always justified if the cooling load required is small.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are is not required in the zone
- Positive or negative pressure is not required
- Dust is a problem in the area
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There are stringent Rh requirements
Recommended systems : Systems with centralised cooling equipment:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Air-water systems

Action : Proceed with questioning
Next question : **C1**

Result of question : No

Knowledge gained : Stringent Rh control is not required
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **E2**

Question index : E2
Previous question : E1

Question : Is cooling equipment acceptable in occupied zones?

Purpose of question : Sometimes it is preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Cooling equipment may also be aesthetically undesirable in the cooling zone. Generally this should not be a problem though.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is a problem in the area
- Stringent Rh control is not necessary
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Cooling equipment is allowed in the zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **E3**

Result of question : No

Knowledge gained : No cooling equipment is allowed in the zone
Recommended systems : A system that does not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Air-water systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : E3
Previous question : E2

Question : Is maintenance acceptable in occupied zones?

Purpose of question : Sometimes it is preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Generally this should not be a problem though.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is a problem in the area
- Stringent Rh control is not necessary
- Cooling equipment is allowed in the occupied zone
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Maintenance is allowed in the zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **E4**

Result of question : No

Knowledge gained : No maintenance is allowed in the zone
Recommended systems : A system that does not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Air-water systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : E4
Previous question : E3

Question : Is the building a small low-rise building?

Purpose of question : Of the systems available it is preferable to install a unitary system in a small low-rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is a problem in the area
- Stringent Rh control is not necessary
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is a small low-rise building
Recommended systems : The following systems:
- Package unit

Systems not recommended : Any of the following:
- All air systems
- Air-water systems

Action : Proceed with questioning
Next question : **P1**

Result of question : No

Knowledge gained : The building is not a small low-rise building
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **E5**

Question index : E5
Previous question : E4

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is a problem in the area
- Stringent Rh control is not necessary
- Cooling equipment is allowed in the occupied zone
- The building is not a small low rise building
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - Air-water system

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost.

Knowledge gained : System with a low initial cost is preferable
Recommended systems : Package units
Systems not recommended : Any of the following:
- All air systems
- Air-water systems

Action : Proceed with questioning
Next question : **P1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : Any of the following:
- All air systems
- Air-water systems

Systems not recommended : Package units
Action : Proceed with questioning
Next question : **J2**

Question Group F

Question index : F1
Previous question : 3/4

Question : Is dust a problem in the area?

Purpose of question : It is preferable to have a central filtration system in areas where dust is a problem. This has the advantage that only one set of filters has to be cleaned regularly. Typical problem areas are offices near to foundries and open cast mines.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Dust is a problem in the area
Recommended systems : Any system that has a centralised filtration system:
- Package units
- All air systems
- Air-water systems

Systems not recommended : Any system that does not have a centralised filtration system:
- Evaporative cooling system

Action : Proceed with questioning to determine system that meets these requirements
Next question : **E1**

Result of question : No

Knowledge gained : Dust is not a problem
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F2**

Question index : F2
Previous question : F1

Question : Is noise control very important?

Purpose of question : It is preferable that noise be kept as low as possible. Low-noise cooling systems are better for office buildings and theatres but usually a lot more expensive. Systems with cooling equipment in the zone are noisier than the other types of systems.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Noise control is very important
Recommended systems : Systems that have centralised cooling equipment:
- Package units
- All air systems
- Air-water systems

Systems not recommended : Any system with cooling equipment in the zone:
- Evaporative cooling systems

Action : Proceed with questioning
Next question : **E1**

Result of question : No

Knowledge gained : Noise control is not very important
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F3**

Question index : F3
Previous question : F2

Question : Are there stringent Rh requirements in the zones.?

Purpose of question : It is preferable to control the Rh because it affects the quality of the air. Humidifiers and dehumidifiers are necessary to accomplish this. The added cost of these components is not always justified if the cooling load required is not very big.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There are stringent Rh requirements
Recommended systems : Systems that have centralised cooling equipment:
- Package units
- All air systems

Systems not recommended : Any system with cooling equipment in the zone:
- Evaporative cooling systems
- Air-water systems

Action : Proceed with questioning
Next question : **C1**

Result of question : No

Knowledge gained : Stringent Rh control is not required
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F4**

Question index : F4
Previous question : F3

Question : Is cooling equipment allowed on the outside of the building (walls, windows or roof)?

Purpose of question : Cooling systems that are installed in windows or on walls may not be very aesthetically pleasing.

Knowledge gained in the previous questions

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Equipment is allowed on the outside of the building
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F5**

Result of question : No

Knowledge gained : Equipment is not allowed on the outside
Recommended systems : Systems that have centralised cooling equipment:
- Package units
- All air systems
- Air-water systems

Systems not recommended : Any system with cooling equipment on the outside:
- Evaporative cooling systems

Action : Proceed with questioning
Next question : **E1**

Question index : F5
Previous question : F4

Question : Is cooling equipment acceptable in occupied zones?

Purpose of question : Sometimes it is preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Cooling equipment may also be aesthetically undesirable in the cooling zone but generally this should not be a problem.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Cooling equipment is allowed in the zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F6**

Result of question : No

Knowledge gained : No cooling equipment is allowed in the zone
Recommended systems : A system that does not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system that has cooling equipment in the zone:
- Air-water systems
- Evaporative cooling systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : F6
Previous question : F5

Question : Is maintenance acceptable in occupied zones?

Purpose of question : Sometimes it is preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Generally this should not be a problem though.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All water systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Maintenance is allowed in the zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F7**

Result of question : No

Knowledge gained : No maintenance is allowed in the zone
Recommended systems : A system that does not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system that has cooling equipment in the zone:
- Air-water systems
- Evaporative cooling systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : F7
Previous question : F6

Question : Is the building a small low-rise building?

Purpose of question : Of the systems available it is preferable to install a unitary system in a small low-rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is a small low-rise building
Recommended systems : The following systems:
- Package units
- Evaporative cooling systems

Systems not recommended : Any of the following:
- All air systems
- Air-water systems

Action : Proceed with questioning
Next question : **Y1**

Result of question : No

Knowledge gained : The building is not a small low-rise building
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **F8**

Question index : F8
Previous question : F7

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usuablly select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- The building is not a small low-rise building
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - Air-water systems
  - Evaporative cooling systems

Result parameters : Lowest initial cost / Lowest life cycle cost

Result of question : Lowest initial cost

Knowledge gained : Systems with a low initial cost are preferable
Recommended systems : The following systems:
- Package units
- Evaporative cooling systems

Systems not recommended : Any of the following:
- All air systems
- Air-water systems

Action : Proceed with questioning
Next question : **Y1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : Any of the following:
- All air systems
- Air-water systems

Systems not recommended : The following systems:
- Package units
- Evaporative cooling systems

Action : Proceed with questioning
Next question : **J2**

Question Group G

Question index : G1
Previous question : 8

Question : Is cooling equipment acceptable in occupied zones?

Purpose of question : Sometimes it is preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas. Cooling equipment may also be aesthetically undesirable in the cooling zone. Generally this should not be a problem though.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Cooling equipment is allowed in the zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **G2**

Result of question : No

Knowledge gained : No cooling equipment is allowed in the zone

Recommended systems : A system that does not have cooling equipment in the zone:

- Package unit
- All air system

Systems not recommended : Any system with cooling equipment in the zone:

- All water system
- Air-water system

Action : Proceed with questioning to determine system that meets these requirements

Next question : **C1**

Question index : G2
Previous question : G1

Question : Is maintenance acceptable in occupied zones?

Purpose of question : Sometimes it is preferable not to have cooling equipment in the zones. Maintenance on these units can disturb office workers or can cause problems if some zones are in restricted areas, but generally this should not be a problem.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Maintenance is allowed in the zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **G3**

Result of question : No

Knowledge gained : No maintenance is allowed in the zone
Recommended systems : A system that does not have cooling equipment in the zone:
- Package units
- All air systems

Systems not recommended : Any system that has cooling equipment in the zone:
- Air-water systems
- All water systems

Action : Proceed with questioning to determine system that meets these requirements
Next question : **C1**

Question index : G3
Previous question : G2

Question : Is it important to cut off the supply to unoccupied zones?

Purpose of question : To cut off the supply to unoccupied zones may be required in office buildings that are rented out. The easiest method is to supply an HVAC system for each of the zones. This leads to high initial cost. There are only a few systems that allows the possibility to cut off the supply to unoccupied zones.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is important to cut off the supply to unoccupied zones

Recommended systems : Systems that have separate units for each zone:

- All water systems

Systems not recommended : Any system with a central unit supplying all the zones of cooled air. It is impractical to cut off the air supply because of the expensive installation, difficult maintenance and balancing of the air supply system

- Package units
- All air systems
- Air-water systems

Action : An all water system is selected

Next question : **P3**

Result of question : No

Knowledge gained	:It is not important to cut off the supply to unoccupied zones
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **G4**

Question index : G4
Previous question : G3

Question : Is the building a small low-rise building?

Purpose of question : Of the systems available it is preferable to install a unitary system in a small low-rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is a small low-rise building
Recommended systems : Package units
Systems not recommended : Any of the following:
  - All water systems
  - All air systems
  - Air-water systems

Action : A package unit is selected
Next question : **P1**

Result of question : No

Knowledge gained : The building is not a small low-rise building
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **G5**

Question index : G5
Previous question : G4

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- The building is not a small low rise building
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost.

Knowledge gained : Systems with a low initial cost are preferable
Recommended systems : Package units
Systems not recommended : Any of the following:
- All air systems
- Air-water systems
- All water systems

Action : A package unit is selected
Next question : **P1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : Any of the following:

- All air systems
- Air-water systems
- All water systems

Systems not recommended : Package units
Action : Proceed with questioning
Next question : **J1**

Question Group H

Question index : H1
Previous question : C1/C3/J2/J3

Question : Is there limited space to install ducts?

Purpose of question : High-speed ducts require less space than low-speed ducts.

Knowledge gained in the previous questions:

- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Low-speed ducts
  - Constant volume variable temperature systems
  - Variable air volume systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is limited space for ducts
Recommended systems	: High-speed ducts
Systems not recommended	: Low-speed ducts
Action	: Proceed with questioning
Next question	: **H5**

Result of question : No

Knowledge gained	: There is enough space for ducts
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **H2**

Question index : H2
Previous question : H1

Question : Is there a big difference between the temperatures in different zones?

Purpose of question : It is preferable to use a constant volume variable temperature system if there is a big difference in the temperatures in the different zones.

Knowledge gained in the previous questions:

- There is space to install ducts
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Low-speed ducts
  - Constant volume variable temperature systems
  - Variable air volume systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is a big difference in temperature
Recommended systems	: Constant volume variable temperature systems
Systems not recommended	: Variable air volume systems
Action	: Proceed with questioning
Next question	: **H7**

Result of question : No

Knowledge gained	: There is not a big difference in temperature
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **H3**

Question index : H3
Previous question : H2

Question : Is noise control very important?

Purpose of question : It is preferable that noise be kept as low as possible. Low-noise cooling systems are better for office buildings and theatres but usually a lot more expensive.

Knowledge gained in the previous questions

- There is space to install ducts
- There is not a big difference in temperatures
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Low-speed ducts
  - Constant volume variable temperature
  - Variable air volume

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: Noise control is very important
Recommended systems	: Low-speed duct constant volume variable temperature system
Systems not recommended	: High-speed duct system
Action	: Proceed with questioning
Next question	: **P1**

Result of question : No

Knowledge gained	: Noise control is not very important
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **H4**

Question index : H4
Previous question : H2

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question :To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions

- There is space to install ducts
- There is not a big difference in temperatures
- Noise is not very important
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Low-speed ducts
  - Constant volume variable temperature systems
  - Variable air volume systems

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained	: Systems with a low initial cost are preferable
Recommended systems	: High-speed ducts variable air volume system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **P1**

Result of question : Low life-cycle cost.

Knowledge gained	: Systems with low operating costs are preferable
Recommended systems	: Low-speed duct variable air volume system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **P1**

Question index : H5
Previous question : H1

Question : Is there a big difference between the temperatures in the different zones?

Purpose of question : It is preferable to use a constant volume variable temperature system if there is a big difference in temperatures in the different zones.

Knowledge gained in the previous questions:

- There is not space to install ducts
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Constant volume variable temperature systems
  - Variable air volume systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is a big difference in temperature
Recommended systems	: High-speed duct constant volume variable temperature system
Systems not recommended	: Variable air volume system
Action	: Proceed with questioning
Next question	: **P1**

Result of question : No

Knowledge gained	: There is not a big difference in temperatures
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **H6**

Question index : H6
Previous question : H5

Question : Is noise control very important?

Purpose of question : It is preferable that noise be kept as low as possible. Low-noise cooling systems are better for office buildings and theatres but usually a lot more expensive.

Knowledge gained in the previous questions

- There is space to install ducts
- There is not a big difference in temperatures
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Constant volume variable temperature systems
  - Variable air volume systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: Noise control is very important
Recommended systems	: High-speed duct constant volume variable temperature system
Systems not recommended	: Variable volume system
Action	: Proceed with questioning
Next question	: **P1**

Result of question : No

Knowledge gained	: Noise control is not very important
Recommended systems	: High-speed duct variable volume system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **P1**

Question index : H7
Previous question : H2

Question : Is noise control very important?

Purpose of question : It is preferable that noise be kept as low as possible. Low-noise cooling systems are better for office buildings and theatres but usually a lot more expensive.

Knowledge gained in the previous questions

- There is space to install ducts
- There is not a big difference in temperatures
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Low-speed ducts
  - Constant volume variable temperature systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: Noise control is very important
Recommended systems	: Low-speed duct constant volume variable temperature system
Systems not recommended	: High-speed duct system
Action	: Proceed with questioning
Next question	: **P1**

Result of question : No

Knowledge gained	: Noise control is not very important
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **H8**

Question index : H8
Previous question : H7

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions

- There is space to install ducts
- There is a big difference in temperatures
- Noise is not very important
- Any of the following systems meet the requirements of the previous questions:
  - High-speed ducts
  - Low-speed ducts
  - Constant volume variable temperature system

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost.

Knowledge gained : Systems with a low initial cost are preferable
Recommended systems : High-speed duct constant volume variable temperature system.
Systems not recommended : None
Action : Proceed with questioning
Next question : **P1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : Low-speed duct constant volume variable temperature
Systems not recommended : None
Action : Proceed with questioning
Next question : **P1**

Question Group I

Question index : I1
Previous question : 13

Question : Is the building a small low-rise building?

Purpose of question : Of the systems available it is preferable to install a unitary system in a small low-rise building.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative cooling systems
  - Package units

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : It is a small low-rise building
Recommended systems : Any of the above
Systems not recommended : None
Action : Proceed with questioning
Next question : **I2**

Result of question : No

Knowledge gained : The building is not a small low-rise building
Recommended systems : Package unit
Systems not recommended : None
Action : A package unit was selected
Next question : **P1**

Question index : I2
Previous question : I1

Question : Are there a small number of large open plan zones?

Purpose of question : Package units are ideally suited for large open plan zones.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- The building is a small low-rise building
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative cooling systems
  - Package units

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There are a small number of large open plan zones
Recommended systems : Package unit
Systems not recommended : One of the following:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Action : A package unit is selected
Next question : **P1**

Result of question : No

Knowledge gained : There are not a small number of large open plan zones
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **I3**

Question index : I3
Previous question : I2

Question : Is a large cooling load required?

Purpose of question : Package units are ideally suited if large cooling load is required.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- The building is a small low-rise office building
- The zones aren't large open plan zones
- Any of the following system meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative cooling systems
  - Package units

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : A large cooling load is needed
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **I4**

Result of question : No

Knowledge gained : A small cooling load is needed
Recommended systems : Any system of the following:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Systems not recommended : Package unit
Action : Proceed with questioning
Next question : **B1**

Question index : I4
Previous question : I3

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- The building is a small low-rise office building
- The zones aren't large open plan buildings
- A large cooling load is needed
- Any of the following system meets the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Split units
  - Evaporative cooling systems
  - Package units

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained : System with a low initial cost is preferable
Recommended systems : The following systems:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Systems not recommended : Package unit
Action : Proceed with questioning
Next question : **B1**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : Package unit
Systems not recommended : The following systems:

- Window-mounted units
- Wall-mounted units
- Split units
- Evaporative cooling systems

Action : A package unit is selected
Next question : **P1**

Question Group J

Question index : J1
Previous question : 13/G5

Question : Is the building a high-rise building?

Purpose of question : All water systems are ideally suited for high-rise buildings.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- Any of the following systems meet the requirements of the previous questions:
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The building is a high-rise building
Recommended systems	: All water system
Systems not recommended	: None
Action	: An all water system is selected
Next question	: **P3**

Result of question : No

Knowledge gained	: The building is not a high rise
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **J2**

Question index : J2
Previous question : E5/F8/J1

Question : Are there a small number of large open plan zones?

Purpose of question : All air systems are ideally suited for large open plan zones.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- The building is not a high-rise building
- Any of the following systems meet the requirements of the previous questions:
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The zones are large open plan zones
Recommended systems	: All air system
Systems not recommended	: None
Action	: An all air system is selected
Next question	: **H1**

Result of question : No

Knowledge gained	: The zones are not large open plan zones
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **J3**

Question index : J3
Previous Question : J2

Question : Are most of the zones perimeter zones?

Purpose of question : Air-water systems are ideally suited when most of the zones are perimeter zones.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is not required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is not allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance is allowed in occupied zone
- It is not necessary to cut off the supply to a zone
- Separate electrical billing is not required
- Design of the system is for lowest initial cost
- The building is not a high rise building
- The zones aren't open plan zones
- Any of the following systems meet the requirements of the previous questions:
  - All air systems
  - All water systems
  - Air-water systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The zones are mostly perimeter zones
Recommended systems	: Air-water system
Systems not recommended	: None
Action	: An air-water system is selected
Next question	: **H1**

Result of question : No

Knowledge gained	: The zones are not large open plan zones
Recommended systems	: All air system
Systems not recommended	: None
Action	: An all air system is selected
Next question	: **H1**

Question Group K

Question index : K1
Previous question : X1/Y1

Question : Is the Rh in the zone high?

Purpose of question : It is better to use an indirect evaporative cooler if the Rh in the zone is high

Knowledge gained in the previous questions:

- Any of the following systems meet the requirements of the previous questions:
  - Direct evaporative coolers
  - Indirect evaporative coolers
  - Multistage evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The Rh in the zone is high
Recommended systems	: Indirect evaporative cooler
Systems not recommended	: Direct evaporative cooler
Action	: An indirect evaporative cooler is selected
Next question	: **End**

Result of question : No

Knowledge gained	: The Rh is zone is not high
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **K2**

Question index : K2
Previous question : K1

Question : Should the Rh be controlled?

Purpose of question : It is better to use a multistage evaporative cooler if the Rh must be controlled in the zone.

Knowledge gained in the previous questions:

- The Rh in the zone is not high.
- Any of the following systems meet the requirements of the previous questions:
  - Direct evaporative coolers
  - Indirect evaporative coolers
  - Multistage evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The Rh must be controlled
Recommended systems	: Multistage evaporative cooler
Systems not recommended	: Direct evaporative cooler
Action	: A multistage evaporative cooler is selected
Next question	: **End**

Result of question : No

Knowledge gained	: The Rh is not a problem
Recommended systems	: Any system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **K3**

Question index : K3
Previous question : K2

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The Rh in the zone is not high
- It is unnecessary to control the Rh in the zone.
- Any of the following systems meet the requirements of the previous questions:
  - Direct evaporative coolers
  - Indirect evaporative coolers
  - Multistage evaporative coolers

Result parameters : Lowest Initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost.

Knowledge gained	: Systems with a low initial cost are preferable
Recommended systems	: Direct evaporative cooler
Systems not recommended	: None
Action	: A direct evaporative cooler is selected
Next question	: **End**

Result of question : Low life-cycle cost

Knowledge gained	: Systems with low operating costs are preferable
Recommended systems	: Multistage evaporative cooler
Systems not recommended	: None
Action	: A multistage evaporative cooler is selected
Next question	: **End**

Question Group P

Question index : P1
Previous question : C2/C4/C5/H3/H4/H5/H6/H7/H8/I1/I2/I3/I4/Y1/Y2/Y3/Y5

Question : Are large volumes of fresh air required in the zone?

Purpose of question : Large volumes of fresh air are needed in zones where odours are a problem. Examples of such zones are lobbies, restaurants, toilets and any zone that is occupied by smokers. Large volumes of fresh air are also needed where a large number of people get together in confined spaces. Examples of such zones are theatres, banks and other public places.

Knowledge gained in the previous questions:

- Any of the following systems meet the requirements of the previous questions:
  - Full fresh air systems
  - Economiser system
  - Air-cooled system
  - Water-cooled system

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: Large volumes of fresh air are required
Recommended systems	: Full fresh air
Systems not recommended	: Economiser
Action	: Proceed with questioning to determine system that meets these requirements
Next question	: **P3**

Result of question : No

Knowledge gained	: Large volumes of fresh air are not required
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **P2**

Question index : P2
Previous question : P1

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- Large volumes of fresh air are not needed
- Any of the following systems meet the requirements of the previous questions:
  - Full fresh air systems
  - Economiser system
  - Air-cooled system
  - Water-cooled system

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained	: Systems with a low initial cost are preferable
Recommended systems	: Full fresh air system
Systems not recommended	: Economiser system
Action	: Proceed with questioning
Next question	: **P3**

Result of question : Low life-cycle cost

Knowledge gained	: Systems with low operating costs are preferable
Recommended systems	: Economiser system
Systems not recommended	: Full fresh air system
Action	: Proceed with questioning
Next question	: **P3**

Question index : P3
Previous question : D1/D3/E4/E5/G3/J1/P1/P2

Question : Is there water for a cooling tower?

Purpose of question : Air-cooled systems must be used if water is available in limited amounts.

Knowledge gained in the previous questions:

- Any of the following systems meet the requirements of the previous questions:
  - Air-cooled system
  - Water-cooled system

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is water for a cooling tower
Recommended systems	: Any system
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **P4**

Result of question : No

Knowledge gained	: There is no water for a cooling system
Recommended systems	: Air-cooled system
Systems not recommended	: Water-cooled
Action	: An air-cooled system is selected
Next question	: **End**

Question index : P4
Previous question : P3

Question : Is there some distance between the equipment room and the installation space for the condenser cooling equipment?

Purpose of question : It is easier to use a water-cooled system if the cooling tower is some distance from the equipment room.

Knowledge gained in the previous questions:

- Any of the following systems meet the requirements of the previous questions:
  - Air-cooled systems
  - Water-cooled systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is some distance
Recommended systems	: Water-cooled system
Systems not recommended	: None
Action	: A water-cooled system is selected
Next question	: **End**

Result of question : No

Knowledge gained	: The two are close together
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **P5**

Question index : P5
Previous question : P4

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- Any of the following systems meet the requirements of the previous questions:
  - Air-cooled system
  - Water-cooled system

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained	: Systems with a low initial cost are preferable
Recommended systems	: Air-cooled system
Systems not recommended	: Water-cooled system
Action	: An air-cooled system is selected
Next question	: **End**

Result of question : Low life-cycle cost

Knowledge gained	: Systems with low operating costs are preferable
Recommended systems	: Water-cooled system
Systems not recommended	: Air-cooled system
Action	: A water-cooled system is selected
Next question	: **End**

Question Group V

Question index : V1
Previous question : NA

Question : Is only ventilation needed?

Purpose of question : Sometimes only ventilation is needed.

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: Only ventilation is necessary
Recommended systems	: Any ventilation system
Systems not recommended	: None
Action	: Resume questioning
Next question	: **V2**

Result of question : No

Knowledge gained	: An air-conditioning system is required
Recommended systems	: Any air-conditioning system
Systems not recommended	: Any ventilation system
Action	: Resume questioning
Next question	: **1**

Question index : V2
Previous question : V1

Question : Is it possible to use natural ventilation?

Purpose of question : It may be possible to design the building to facilitate natural ventilation.

Knowledge gained in the previous questions:

- Only ventilation is necessary

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: It is possible to use natural ventilation
Recommended systems	: Natural ventilation
Systems not recommended	: None
Action	: Natural ventilation is selected
Next question	: **End**

Result of question : No

Knowledge gained	: Mechanical ventilation is necessary
Recommended systems	: Mechanical ventilation
Systems not recommended	: Natural ventilation
Action	: Mechanical ventilation is selected
Next question	: **End**

Question Group X

Question index : X1
Previous question : B3

Question : Is the outdoor Rh high?

Purpose of question : Evaporative coolers are very sensitive to the outside Rh because of their method of operation. Evaporative cooling becomes very ineffective with high Rh. The outside Rh is typically high at the coast.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is no space for an equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is no space for ducts in the building(A2)
- The cooling equipment doesn't have to be aesthetically pleasing
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : The outside Rh is high
Recommended systems : The following systems:
- Window-mounted units
- Wall-mounted units

Systems not recommended : Evaporative cooling system
Action : End of questioning
Next question : **End**

Result of question : No

Knowledge gained : The outside Rh is not high.
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **X2**

Question index : X2
Previous question : X1

Question : Is there water for an evaporative cooler?

Purpose of question : It is preferable to use clean water for an evaporative cooler. Sometimes it may not be acceptable to use drinking water.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is no space for an equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is no space for ducts in the building(A2)
- The cooling equipment does not have to be aesthetically pleasing
- The outside Rh is not high
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : There is water
Recommended systems : Any of the above systems
Systems not recommended : None of the above
Action : Proceed with questioning
Next question : **X3**

Result of question : No

Knowledge gained : There is no water
Recommended systems : The following systems:
- Window-mounted units
- Wall-mounted units

Systems not recommended : Evaporative cooling system
Action : End of questioning
Next question : **End**

Question index : X3
Previous question : X2

Question : Is the Rh in the zone high?

Purpose of question : The air leaving an evaporative cooler has a very high Rh. This makes it unsuitable for application where the zone Rh is high. A typical example is a change house where a large number of people are showering.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is no space for an equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is no space for ducts in the building(A2)
- The cooling equipment does not have to be aesthetically pleasing
- The outside Rh is not high
- There is water for a cooling system
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : The zone Rh is high
Recommended systems : The following systems
- Window-mounted units
- Wall-mounted units

Systems not recommended : Evaporative cooling system
Action : End of questioning
Next question : **End**

Result of question : No

Knowledge gained : The zone Rh is not high
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **X4**

Question index : X4
Previous question : X3

Question : Is dust a problem in the area?

Purpose of question : The membranes of an evaporative cooler get blocked by dust and must be cleaned regularly. Typical problem areas are offices near to foundries and open cast mines.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is no space for a equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is no space for ducts in the building(A2)
- The cooling equipment does not have to be aesthetically pleasing
- The outside Rh is not high
- There is water for a cooling system
- The Rh in the zone is not high
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Dust is a problem
Recommended systems : The following systems
- Window-mounted units
- Wall-mounted units

Systems not recommended : Evaporative cooling system
Action : End of questioning
Next question : **End**

Result of question : No

Knowledge gained : Dust is not a problem
Recommended systems : Any of the above systems
Systems not recommended : None
Action : Proceed with questioning
Next question : **X5**

Question index : X5
Previous question : X4

Question : Should the building be environmentally friendly?

Purpose of question : Evaporative coolers have a lower impact on the environment because of their low energy consumption and because they do not use refrigerants.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is no space for a equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is no space for ducts in the building (A2)
- The cooling equipment does not have to be aesthetically pleasing
- The outside Rh is not high
- There is water for a cooling system
- The Rh in the zone is not high
- Dust is not a problem
- Any of the following systems meet the requirements of the previous questions:
  - Window-mounted units
  - Wall-mounted units
  - Evaporative coolers

Result parameters : Yes/No

Result of question : Yes

Knowledge gained : Systems should be environmentally friendly
Recommended systems : Evaporative coolers
Systems not recommended : The following systems
- Window-mounted units
- Wall-mounted units

Action : Proceed with questioning
Next question : **K1**

Result of question : No

Knowledge gained : System does not have to be environmentally friendly
Recommended systems : Any of the above system
Systems not recommended : None of the above
Action : Proceed with questioning
Next question : **X6**

Question index : X6
Previous question : X5

Question : Should the system be selected on the lowest initial cost or on the lowest 20-year life-cycle cost?

Purpose of question : To determine the emphasis considerations for the selection of the system. Generally systems with a low initial cost have high running costs and vice versa. A developer will usually select a system with a low initial cost, where as the owner of a building will select a system with a low life-cycle cost.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are space limitations(2)
- There are no internal zones
- There is no space for a equipment room
- Cooling equipment may be installed in the windows
- There is space for ducts(A3)
- There is no space for ducts in the building(A2)
- The cooling equipment does not have to be aesthetically pleasing
- The outside Rh is not high
- There is water for a cooling system
- The Rh in the zone is not high
- Dust is not a problem
- The system does have to be environmentally friendly
- Any of the following system meet the requirements of the previous questions:
  - Window-mounted Units
  - Wall-mounted Units
  - Evaporative coolers

Result parameters : Lowest initial cost / Lowest life-cycle cost

Result of question : Lowest initial cost

Knowledge gained : Systems with a low initial cost are preferable
Recommended systems : The following systems
- Window-mounted units
- Wall-mounted units

Systems not recommended : Evaporative coolers
Action : End of questioning
Next question : **End**

Result of question : Low life-cycle cost

Knowledge gained : Systems with low operating costs are preferable
Recommended systems : Evaporative coolers
Systems not recommended : The following systems
- Window-mounted units
- Wall-mounted units

Action : Proceed with questioning
Next question : **K1**

Question Group Y

Question index : Y1
Previous question : F7/F8

Question : Is the outdoor Rh high?

Purpose of question : Evaporative coolers are very sensitive to the outside Rh because of their method of operation. Evaporative cooling becomes very ineffective with high Rh. The outside Rh is typically high at the coast.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- The building is a small low-rise building
- The design emphasis is on lowest initial cost
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The outside Rh is high
Recommended systems	: Package unit
Systems not recommended	: Evaporative cooling system
Action	: A package unit is selected
Next question	: **P1**

Result of question : No

Knowledge gained	: The outside Rh is not high
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **Y2**

Question index : Y2
Previous question : Y1

Question : Is there water for an evaporative cooler?

Purpose of question : It is preferable to use clean water for an evaporative cooler. Sometimes it may not be acceptable to use drinking water.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- The building is a small low-rise building
- The design emphasis is on lowest initial cost
- The Rh outside is not high
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: There is water
Recommended systems	: Any of the above systems
Systems not recommended	: None of the above
Action	: Proceed with questioning
Next question	: **Y3**

Result of question : No

Knowledge gained	: There is no water
Recommended systems	: Package unit
Systems not recommended	: Evaporative cooling system
Action	: A package unit is selected
Next question	: **P1**

Question index : Y3
Previous question : Y2

Question : Is the Rh in the zone high?

Purpose of question : The air leaving a evaporative cooler has a very high Rh. This makes it unsuitable for application where the zone Rh is high. A typical example is a change house where a large number of people are showering.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- The building is a small low-rise building
- The design emphasis is on lowest initial cost
- The Rh outside is not high
- There is a water for a evaporative cooler
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The zone Rh is high
Recommended systems	: Package unit
Systems not recommended	: Evaporative cooling system
Action	: A package unit is selected
Next question	: **P1**

Result of question : No

Knowledge gained	: The zone Rh is not high
Recommended systems	: Any of the above systems
Systems not recommended	: None
Action	: Proceed with questioning
Next question	: **Y4**

Question index : Y4
Previous question : Y3

Question : Should the building be environmentally friendly?

Purpose of question : Evaporative coolers have a lower impact on the environment because of their low energy consumption and because they do not use refrigerants.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- The building is a small low-rise building
- The design emphasis is on lowest initial cost
- The Rh outside is not high
- There is water for an evaporative cooler
- The zone Rh is not high
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: Systems should be environmentally friendly
Recommended systems	: Evaporative cooler
Systems not recommended	: Package unit
Action	: An evaporative cooler is selected
Next question	: **K1**

Result of question : No

Knowledge gained	: System does not have to be environmentally friendly
Recommended systems	: Any of the above systems
Systems not recommended	: None of the above
Action	: Proceed with questioning
Next question	: **Y5**

Question index : Y5
Previous question : Y4

Question : Is a large cooling load necessary?

Purpose of question : It is preferable to use a package unit when a large cooling load is needed.

Knowledge gained in the previous questions:

- The system is for a new or retrofit building
- There are no space limitations
- Large volumes of fresh air are not required in the zone
- Positive or negative pressure is required
- Dust is not a problem in the area
- Noise is not a very important consideration
- Stringent Rh control is not necessary
- Cooling equipment is allowed on the outside of the building
- Cooling equipment is allowed in the occupied zone
- Maintenance inside the occupied zone is allowed
- The building is a small low-rise building
- The design emphasis is on lowest initial cost
- The Rh outside is not high
- There is water for an evaporative cooler
- The zone Rh is high
- The system does not have to be environmentally friendly
- Any of the following systems meet the requirements of the previous questions:
  - Package units
  - Evaporative cooling systems

Result parameters : Yes/No

Result of question : Yes

Knowledge gained	: The cooling load is large
Recommended systems	: Package unit
Systems not recommended	: None
Action	: A package unit is selected
Next question	: **P1**

Result of question : No

Knowledge gained	: The cooling load is not large
Recommended systems	: Evaporative cooling system
Systems not recommended	: None
Action	: An evaporative cooling system is selected
Next question	: **K1**