

Section II

60 marks

Attempt Questions 21–23

Allow about 1 hour and 50 minutes for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

If you include diagrams in your answer, ensure that they are clearly labelled.

Question 21 (20 marks)

Please turn over

Question 21 (20 marks) Use a SEPARATE writing booklet.

- (a) The following algorithm segment is *DisplayTrain*, part of a major software development project designed to manage and operate an electric railway system. *DisplayTrain* is intended to record the location of any train within the rail network, and display a train indicator on a large display screen.

DisplayTrain is intended to operate by broadcasting a message that requests the location of the train. A signal is returned indicating the location in terms of X and Y coordinates that describe its grid reference. The TrainID is then displayed on a map at the location of the X and Y coordinates. The system is in a continuous loop that monitors trains at all times. TrainID is a unique value allocated by the process ReadTrainID.

ReadTrainID, BroadcastMessage and ReceiveMessage are procedures defined elsewhere in the project.

During the initial testing of the software, *DisplayTrain* did not perform as expected.

```
① BEGIN DisplayTrain
②     read NumberOfTrains
③     Train = 1
④     WHILE Train <>NumberOfTrains
⑤         ReadTrainID (TrainID)
⑥         ReadLocation (TrainID, LocationX, LocationY)
⑦         DisplayTrainID (TrainID, LocationX, LocationY)
⑧         Train = Train + 1
⑨     ENDWHILE
⑩ END

⑪ BEGIN ReadLocation (TrainID, LocationX, LocationY)
⑫     X = LocationX
⑬     Y = LocationY
⑭     BroadcastMessage (TrainID)
⑮     ReceiveMessage (X, Y)
⑯ END

⑰ BEGIN DisplayTrainID (TrainID, LocationX, LocationY)
⑱     display TrainID at X, Y
⑲ END
```

Question 21 continues on page 13

Question 21 (continued)

You have been employed to locate any points of error and recommend solutions to the algorithm.

- | | | |
|-------|--|----------|
| (i) | Design and perform a desk check. The test data should include NumberOfTrains = 0, 1 and 2. | 3 |
| (ii) | Explain, with reference to your desk check, why the algorithm does not work. (The test data should include NumberOfTrains = 0, 1 and 2.) | 3 |
| (iii) | How would you modify the algorithm to ensure that the software component operates as intended? | 4 |
- (b) A team of software programmers is asked to put together a package similar to the *DisplayTrain* program. All team members are asked to find a solution and then pool their discoveries. One of the team members decides to use the Internet and downloads a run-time component from another manufacturer's closed website. However, this member does not give the website address and details of who actually wrote the code. The code is passed on to the team as the member's programming code.
- | | | |
|------|---|----------|
| (i) | Outline the ethical issues that are involved in this scenario. | 4 |
| (ii) | Discuss ways in which management could ensure that the software team carry out their responsibilities as software developers. | 6 |

End of Question 21