D1 (Year 2) – Planarity Algorithm Exam Questions (Edexcel)

Q1.

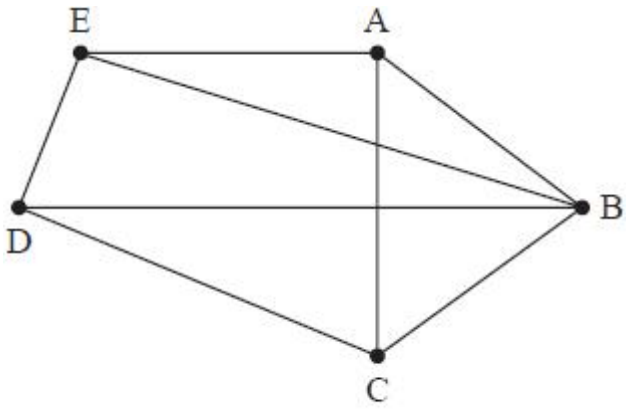


Figure 1

Figure 1 shows the graph G.

(a) State whether G is Eulerian, semi-Eulerian, or neither, giving a reason for your answer.

(1)

(b) Write down an example of a Hamiltonian cycle on G.

(1)

(c) State whether or not G is planar, justifying your answer.

(1)

(d) State the number of arcs that would need to be added to G to make the graph K_5

(1)

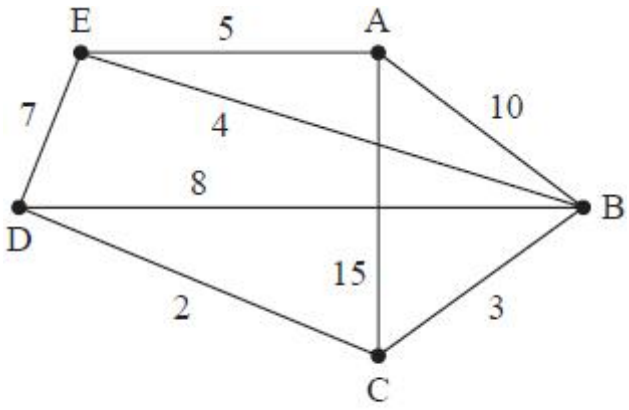


Figure 2

Direct roads between five villages, A, B, C, D and E, are represented in Figure 2. The weight on each arc is the time, in minutes, required to travel along the corresponding road. Floyd's algorithm is to be used to find the complete network of shortest times between the five villages.

(e) For the network represented in Figure 2, complete the initial time matrix in the answer book.

(1)

The time matrix after four iterations of Floyd's algorithm is shown in Table 1.

e

(f) Perform the final iteration of Floyd's algorithm that follows from Table 1, showing the time matrix for this iteration.

(2)

	A	B	C	D	E
A	–	10	13	15	5
B	10	–	3	5	4
C	13	3	–	2	7
D	15	5	2	–	7
E	5	4	7	7	–

Table 1

(Total for question = 7 marks)

(Q01 9FM0/03D, June 2023)

Q2.

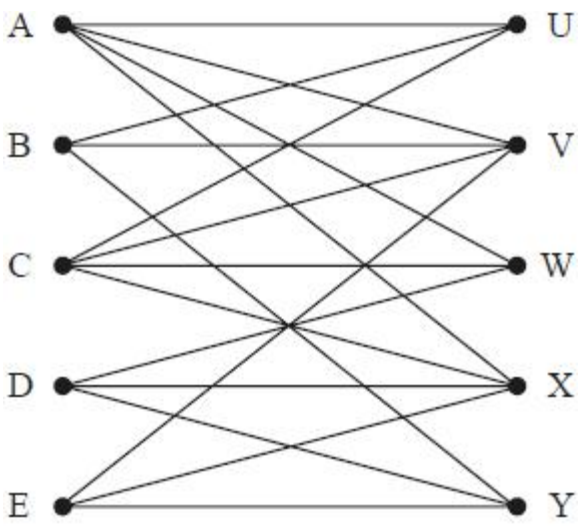


Figure 1

A Hamiltonian cycle for the graph in Figure 1 begins C, V, E, X, A, W, ...

(a) Complete the Hamiltonian cycle.

(1)

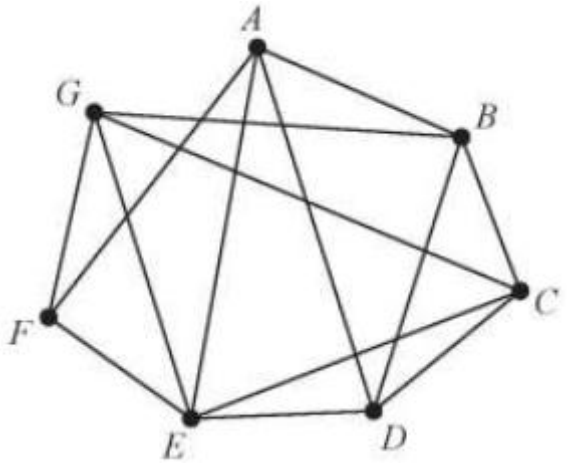
(b) Hence use the planarity algorithm to determine whether the graph shown in Figure 1 is planar. You must make your working clear and justify your answer.

(3)

(Total for question = 4 marks)

(Q01 9FM0/03D, Oct 2021)

Q3.



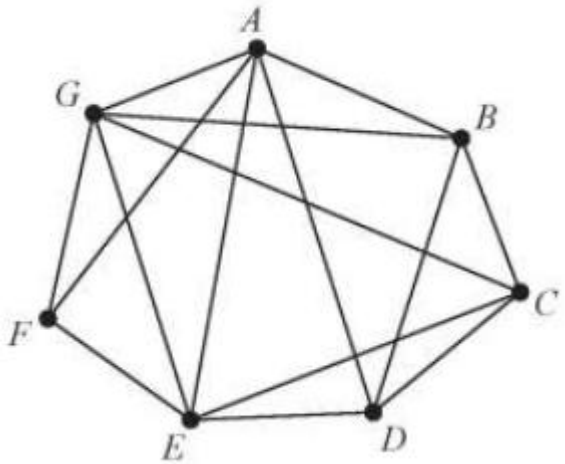
(a) Define what is meant by a **planar** graph.

(2)

(b) Starting at A, find a Hamiltonian cycle for the graph in Figure 1.

(1)

Arc AG is added to Figure 1 to create the graph shown in Figure 2.



Taking ABCDEFGA as the Hamiltonian cycle,

(c) use the planarity algorithm to determine whether the graph shown in Figure 2 is planar. You must make your working clear and justify your answer.

(4)

(Total for question = 7 marks)

(Q02 9FM0/3D-4D, Specimen papers)