0 1 **Figure 3** shows a partial solution to a logic puzzle. To complete the solution each of the letters A-I must appear exactly once in each row of nine cells, exactly once in each column of nine cells and exactly once in each of the collections of three-by-three cells shown with limits shown by a thicker border.

In **Figure 3** the logic puzzle has been completed except for the collection of three-by-three cells in the top-right corner.

Figure 3

D	F	G	B	A	C			
I	E	H	F	G	D			
A	B	C	I	H	E			
B	G	D	E	C	H	A	F	I
F	H	I	D	B	A	E	G	C
C	A	E	G	I	F	B	H	D
H	D	B	C	E	G	F	I	A
G	C	F	A	D	I	H	B	E
E	I	A	H	F	B	D	C	G

0 1 . 1 Complete the solution for the puzzle shown in **Figure 3**.

Copy the contents of the unshaded cells in **Figure 3** into the table in your Electronic Answer Document.

[1 mark]

Figure 4 shows a simpler example of this type of logic puzzle with fewer cells. In this simpler puzzle only the letters A-D are used.

Figure 4

C			B
		A	
	B		
			A

It is possible to represent this type of puzzle as a graph. To do this a unique number is given to each cell and a node containing this unique number is added to the graph. An edge between two nodes denotes a link between those two cells, meaning they cannot contain the same letter as each other.

Figure 5 shows how unique numbers have been allocated to each cell in the puzzle in **Figure 4** and **Figure 6** shows an adjacency matrix that represents this puzzle.

Figure 5

0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

Figure 6

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
0		1	1	1	1	1	0	0	1	0	0	0	1	0	0	0
1			1	1	1	1	0	0	0	1	0	0	0	1	0	0
2				1	0	0	1	1	0	0	1	0	0	0	1	0
3					0	0	1	1	0	0	0	1	0	0	0	1
4						1	1	1	1	0	0	0	1	0	0	0
5							1	1	0	1	0	0	0	1	0	0
6								1	0	0	1	0	0	0	1	0
7									0	0	0	1	0	0	0	1
8										1	1	1	1	1	0	0
9											1	1	1	1	0	0
10												1	0	0	1	1
11													0	0	1	1
12														1	1	1
13															1	1
14																1
15																

The graph in **Figure 6** can be considered to be both a representational abstraction and an abstraction by generalisation of the puzzle from **Figure 4**.

0 1 . 2 What is representational abstraction?

[1 mark]

0 1 . 3 What is abstraction by generalisation?

[1 mark]

0 1 . 4 Other than the contents of the cells, what information has been removed from the puzzle in **Figure 4** when it has been represented as a graph?

[1 mark]

A graph can be represented using an adjacency list or as an adjacency matrix.

0 1 . 5 Explain the circumstances when it would be more appropriate to use an adjacency matrix instead of an adjacency list.

[2 marks]

0 1 . 6 Only the top half of the matrix in **Figure 6** needed to be used to present the puzzle. For which type of graph would the bottom half of the matrix also need to be used?

[1 mark]

0 2 Explain what is meant by procedural decomposition.

[3 marks]

0 3 **Figure 2** shows a logic puzzle.

Figure 2

Which one of these six statements is correct?

Statement 1: All of the statements below are correct.

Statement 2: None of the statements below are correct.

Statement 3: All of the statements above are correct.

Statement 4: Exactly one of the statements above is correct.

Statement 5: None of the statements above are correct.

Statement 6: None of the statements above are correct.

0 3 . 1 Explain why Statement 1 is not correct.

[1 mark]

0 3 . 2 Which one of the six statements in **Figure 2** is correct?

[1 mark]

0 3 . 3 For **two** statements other than Statement 1 and your answer to Question **03.2**, explain why those statements are not correct.

[2 marks]

0 4 **Figure 1** shows a logic puzzle.

Figure 1

The following five coloured shapes are placed on a table.

Image of coloured shapes not reproduced here due to third party copyright restrictions.

Tabitha secretly chooses one of the coloured shapes and:

- tells Walter the colour of the shape she has chosen (pink, yellow or blue)
- tells Lionel the type of shape she has chosen (triangle, circle or square).

Lionel and Walter both know what coloured shapes are on the table.

Lionel knows that Walter has been told the colour chosen by Tabitha.
Walter knows that Lionel has been told the type of shape chosen by Tabitha.
They do not know what the other has been told.

Tabitha first asks Walter and Lionel if they know which coloured shape she has chosen. They both answer at the same time and say "No".

Tabitha then asks them again if they know which coloured shape she has chosen. They both answer at the same time and say "No" again.

Tabitha asks them a third time if they know which coloured shape she has chosen and they both answer at the same time and say "Yes".

0 4 . 1 After they have both replied to Tabitha's **first** question, what does Lionel now know about Tabitha's choice because Walter said "No"?

[1 mark]

0 4 . 2 After they have both replied to Tabitha's **first** question, what does Walter now know about Tabitha's choice because Lionel said "No"?

[1 mark]

0 4 . 3 Which coloured shape had Tabitha chosen?

[1 mark]