**Question 2** **(10 marks)**

A construction company uses five different machines and has five employees who operate those machines.

The adjacency matrix below shows each of the five employees (A, B, C, D, E) and the five machines they are trained to operate. These are the only machines they may use.

$$
\text{Machine}\quad
\begin{array}{c}
\\
1 \\ 2 \\ 3 \\ 4 \\ 5
\end{array}
\begin{array}{c}
\text{Employee} \\
\begin{array}{ccccc}
A & B & C & D & E
\end{array} \\
\begin{bmatrix}
1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 \\
1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0
\end{bmatrix}
\end{array}
$$

(a)   Draw the adjacency matrix as a bipartite graph. The A1 connection has already been drawn on the graph. (2 marks)
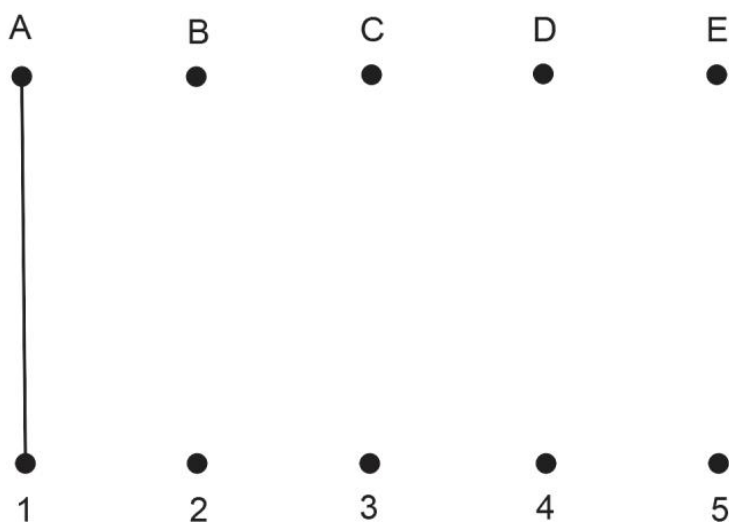
(b)   Does the bipartite graph in part (a) represent

   (i)   a planar graph?   (1 mark)

   (ii)   a connected graph?   (1 mark)

(c)   Explain why the bipartite graph in part (a) is a simple graph.   (2 marks)

(d)   Complete the table below to show how an allocation of all employees to a machine could be achieved.   (2 marks)

A   B   C   D   E
●   ●   ●   ●   ●

●   ●   ●   ●   ●
1   2   3   4   5
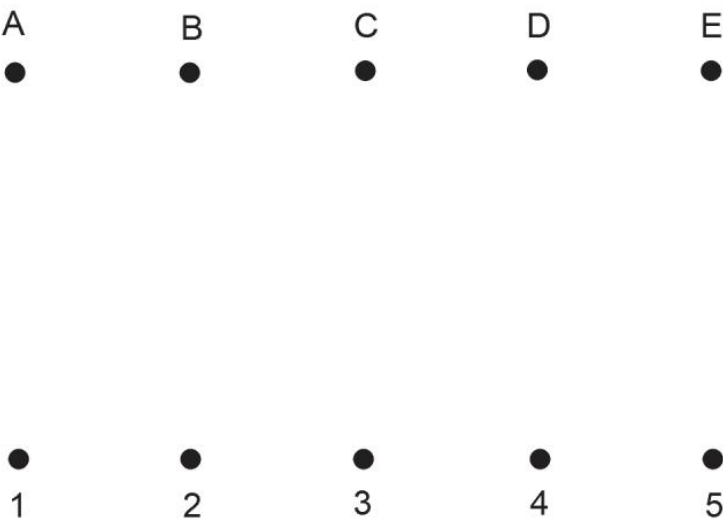
Employee	A	B	C	D	E
Machine					

(e)   The company foreman decides to allocate Employee E to Machine 4. Explain what effect this will have to the allocation of the remaining employees to the machines.   (2 marks)