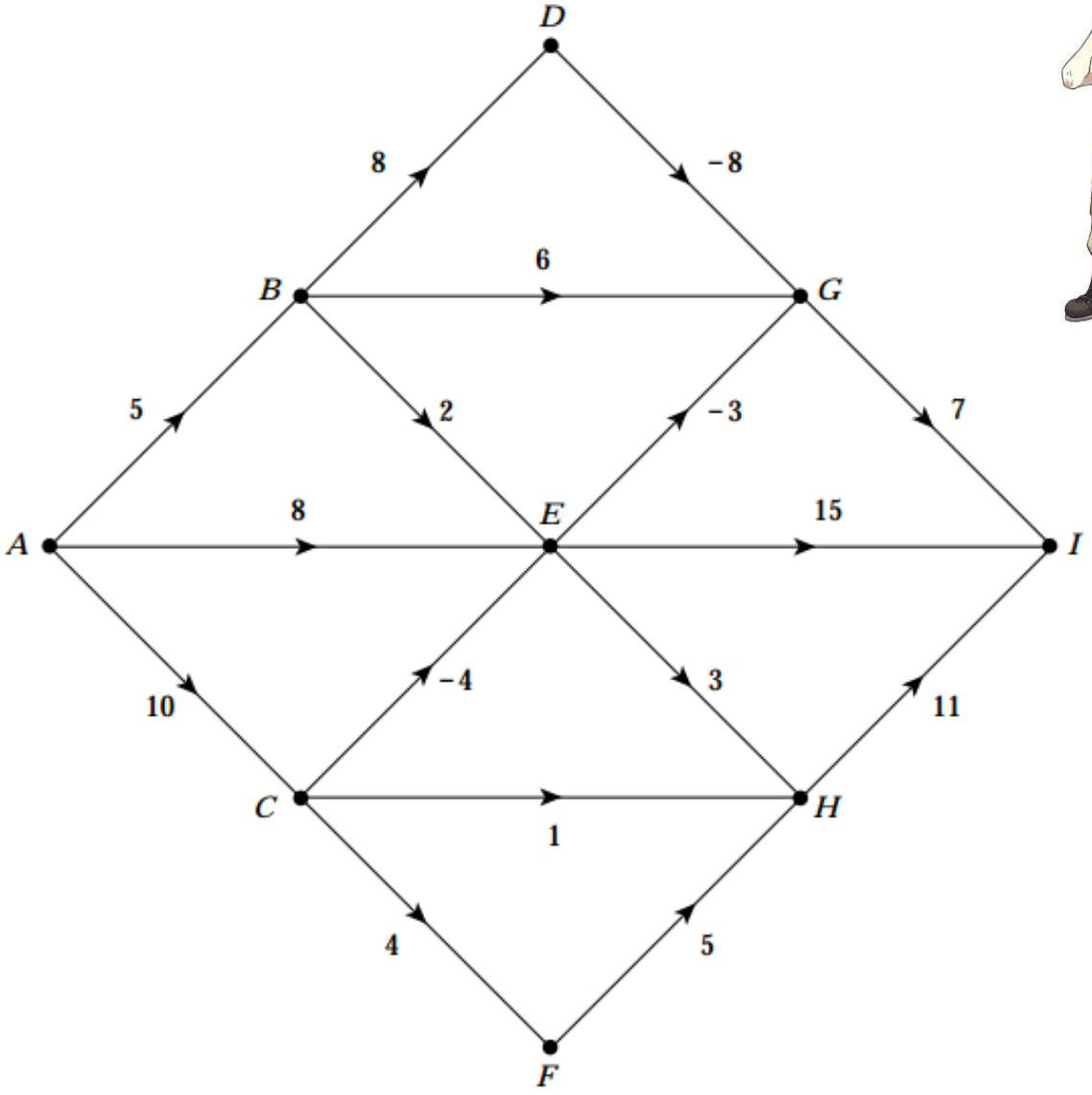
D2 Dynamic programming Challenge

Challenge 1

[**Figure 1**, printed on a separate sheet, is provided for use in answering this question.]

The following network shows nine vertices with the numbers on the arcs being the cost of a journey between pairs of vertices.

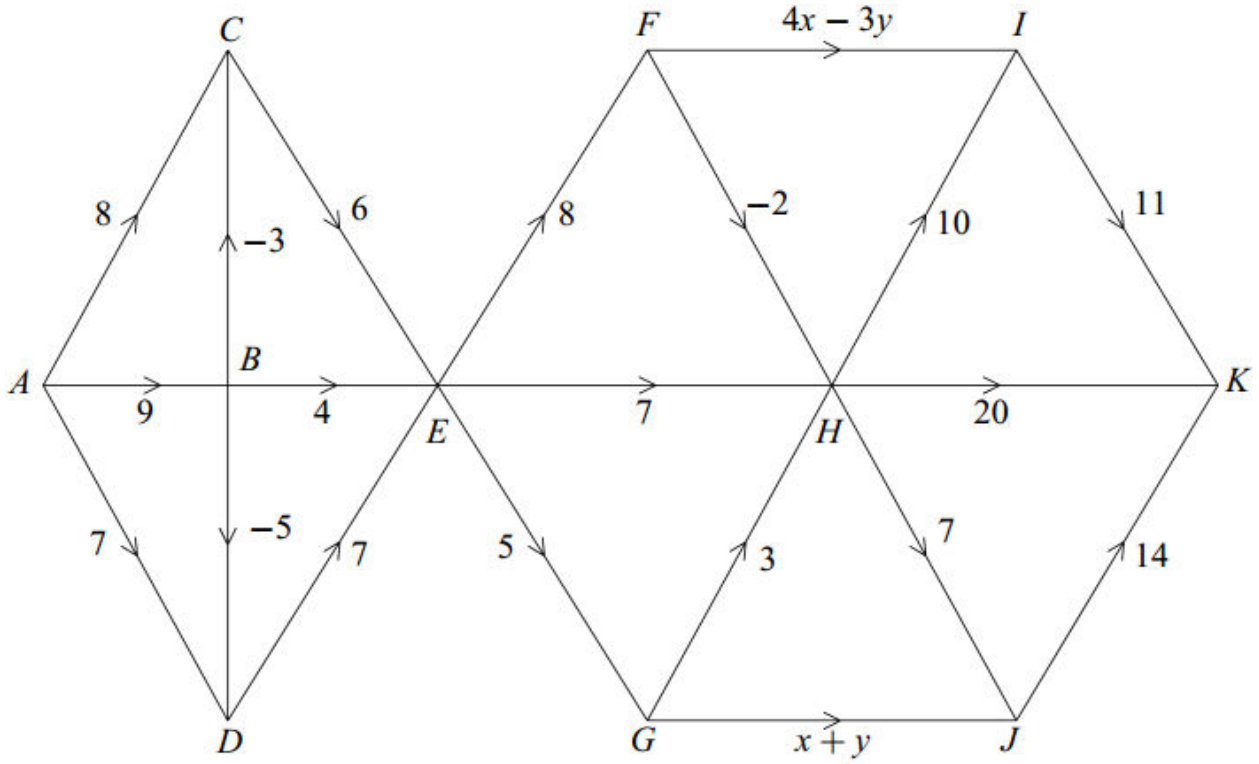


Use dynamic programming on **Figure 1** to find the minimum cost of a route from *A* to *I*. State the route corresponding to this minimum cost. *(7 marks)*

Challenge 2

[**Figure 5**, printed on the insert, is provided for use in answering this question.]

The following network has 11 vertices and arcs connecting some pairs of vertices. The numbers on the arcs are their weights. The weights on the arcs FI and GJ are functions of x and y.



Given that there are three routes from A to K of the same minimum weight, use dynamic programming to find:

(a) this minimum weight; *(6 marks)*

(b) the values of x and y. *(3 marks)*

Final Challenge

Over a three week period, a small plastics company is to prepare mouldings of three types of Christmas figure: Father Christmas (F), Reindeer (R) and Snowman (S). One moulding is to be prepared each week. The cost of preparing the three mouldings varies according to the mouldings previously prepared. The company wishes to keep its preparation costs to a minimum.

The costs, in pounds, are given in the table below.

Week	Previous moulding(s)	Cost (£000's)		
		F	R	S
1	–	330	360	390
2	F	–	300	330
	R	380	–	270
	S	400	290	–
3	F and R	–	–	300
	F and S	–	250	–
	R and S	270	–	–

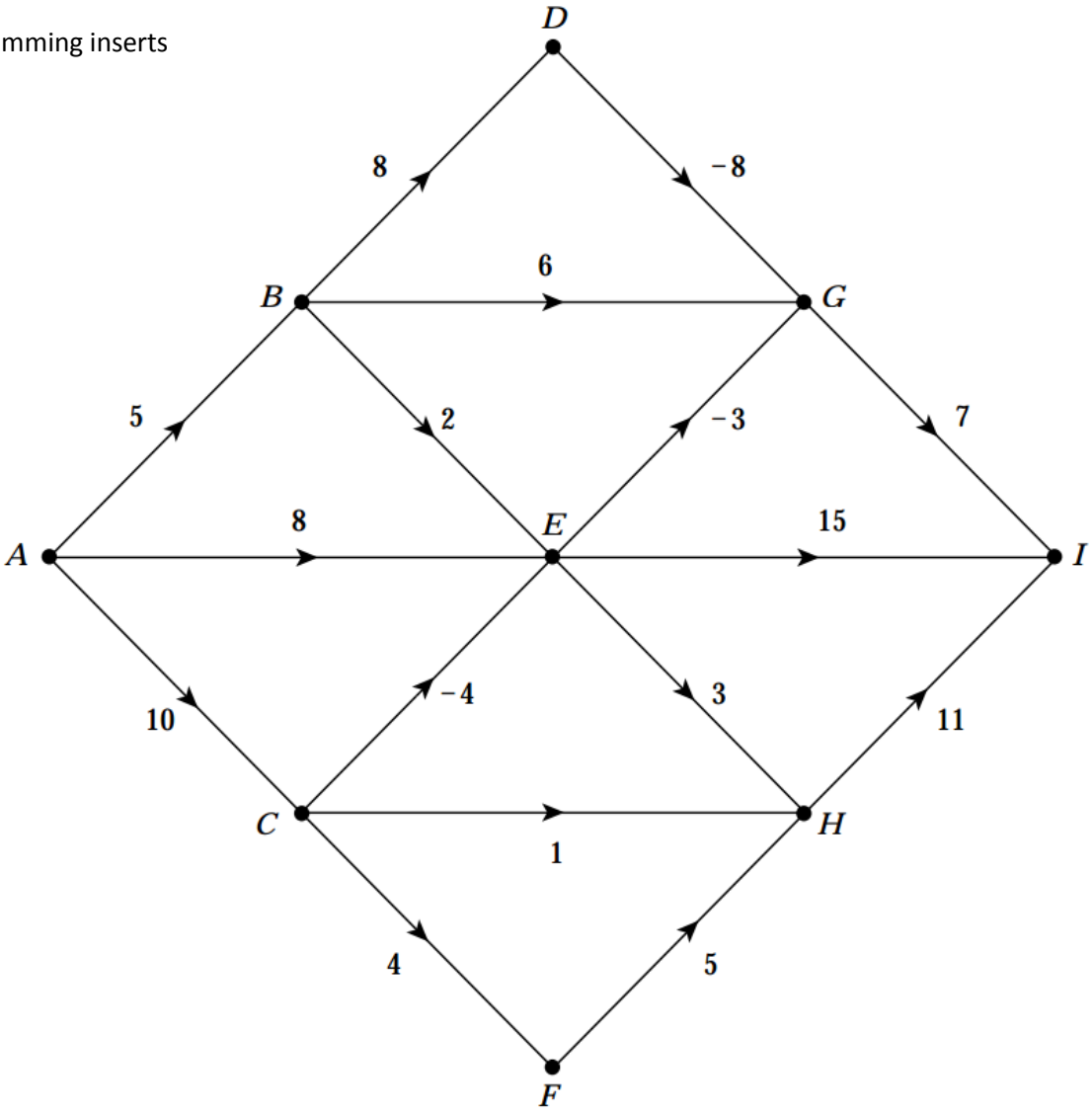
(a) Use dynamic programming, together with a labelled network, or otherwise, to determine the order of preparing the mouldings that minimises the total cost to the company.

(9 marks)

(b) The company decides that it must make the Father Christmas first. Find the minimum extra cost to the company.

(2 marks)

Dynamic programming inserts



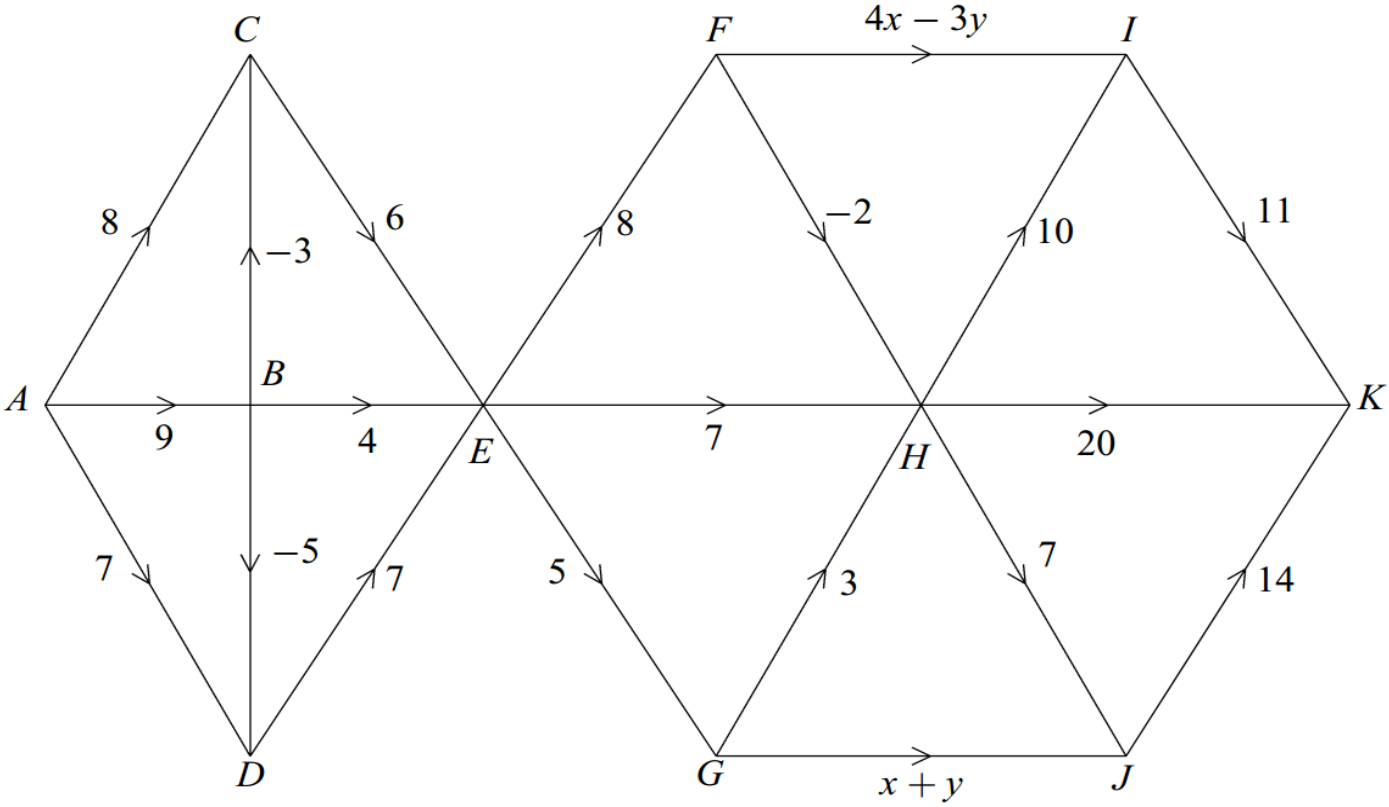


Figure 5 (for Question 6)