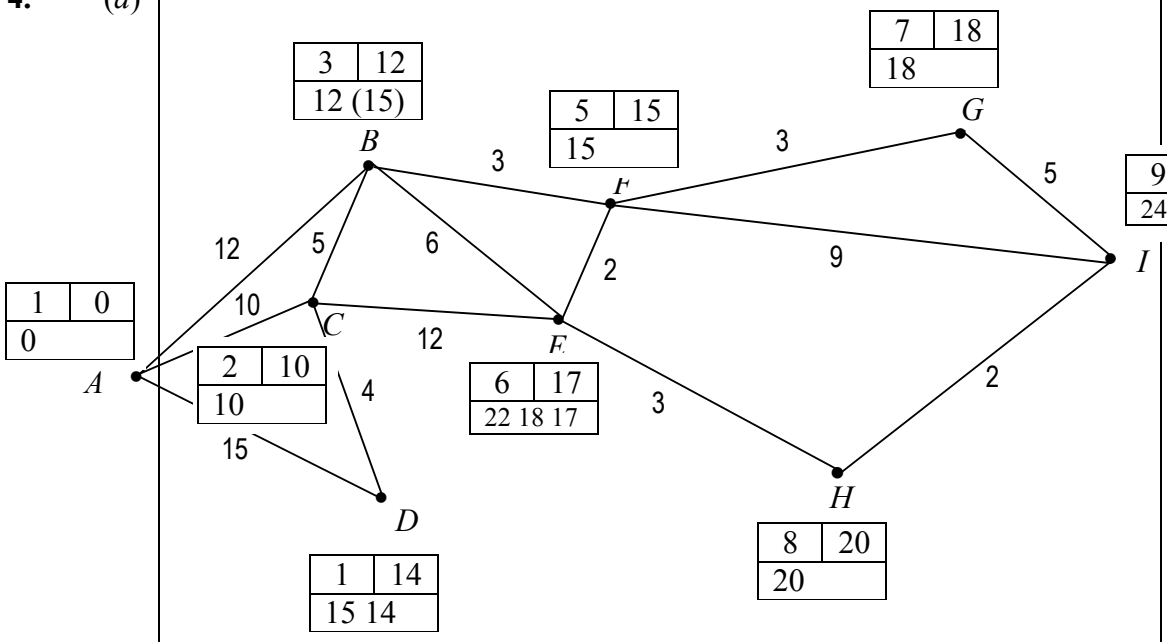
Question Number	Scheme	Marks
1.	6 1 18 12 (9) 0 5 13 14 18 12 (13) 14 [9] 6 1 (0) 5 18 (14) [13] (12) [9] 6 (1) 5 [0] (18) [14] [13] [12] [9] 6 [5] [1] [0] [18] [14] [13] [12] [9] (6) [5] [1] [0] [18] [14] [13] [12] [9] [6] [5] [1] [0] Datchet (18), Wraysbury (14), Staines (13), Feltham (12), Halliford (9), Ashford (6), Poyle (5), Colnbrook (1), Laleham (0).	M1 A1 A1 A1 A1 **(5)** **(5 marks)**
2. (*a*)	No negative elements in the profit row.	B1 **(1)**
(*b*)	$P = 11, x = 1, y = \frac{1}{3}, z = 0;\ r = \frac{2}{3}s = 0, t = 0$	M1 A1; A1 **(3)**
(*c*)	$P + z + s + t = 11$ $\Rightarrow P = 11 - z - s - t$ so increasing z, s or t would decrease P.	B1 B1 **(2)**
		(6 marks)
3. (*a*)	$1 - C$ $1 - C$ $2 - B$ $2 - A$ $3 - B$ and $3 - D$ $4 - E$ $4 - B$ $5 - D$ $5 - A$	B1 B1 **(2)**
(*b*)	$2 - B = 4 - C = 1 - E$ $2 - D = 5 - E$	M1 A1 M1 A1 **(4)**
		(6 marks)

Question Number	Scheme	Marks
4. (*a*)		M1 A1 A1 **(3)**
	Shortest route *ABFEHI*, length 22 km	B1 B1 **(2)**
(*b*)(i)	Odd vertices *A* and *I* only, shortest route between them needs to be repeated, hence repeat	M1
	AB, *BF*, *FE*, *EH*, *HI*	A1
(ii)	e,g. *AB FB EF GI FE HI HE CDACB A*	A1 **(3)**
(ii)	91 + 22 = 113 km	M1 A1 **(2)**
		(Marks 10)

Question Number	Scheme	Marks
5. (*a*)		

a	*b*	*c*	*d*	*e*	*f*	*f* = 0?
645	255	2.53	2	510	135	No
255	135	1.89	1	135	120	No
135	120	1.13	1	120	15	No
120	15	8	8	120	0	Yes

M1 A1

M1 A1

A1

A1

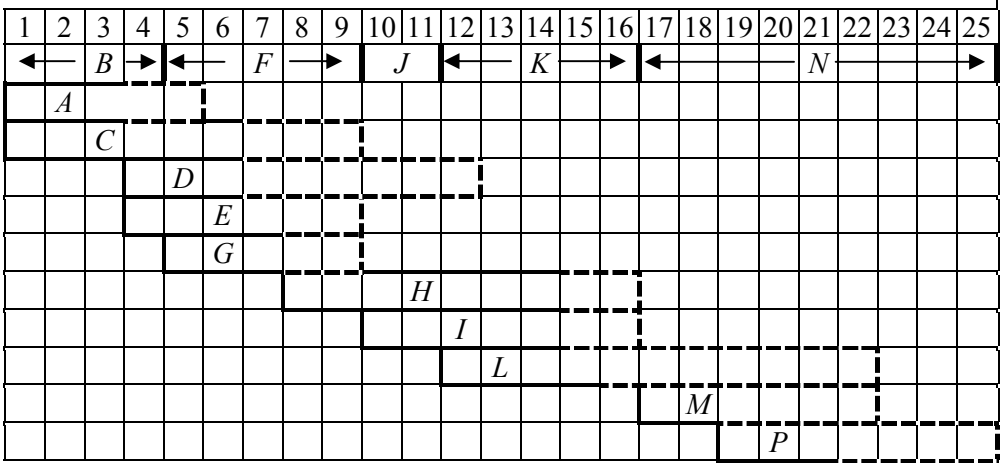
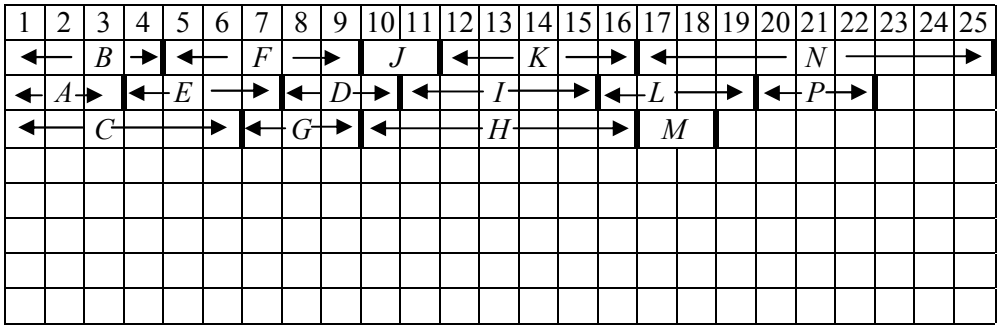
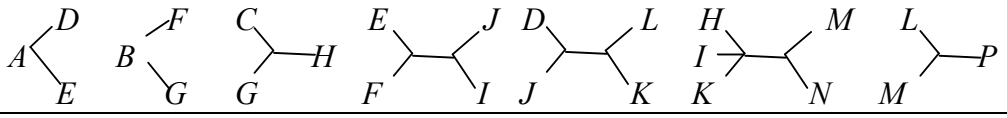
The answer is 15 — A1 **(7)**

(*b*) The first row would be
255 645 0.40 0 0 255 No — M1 A1

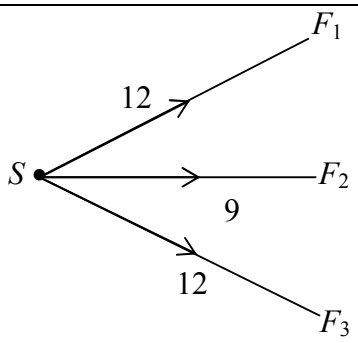
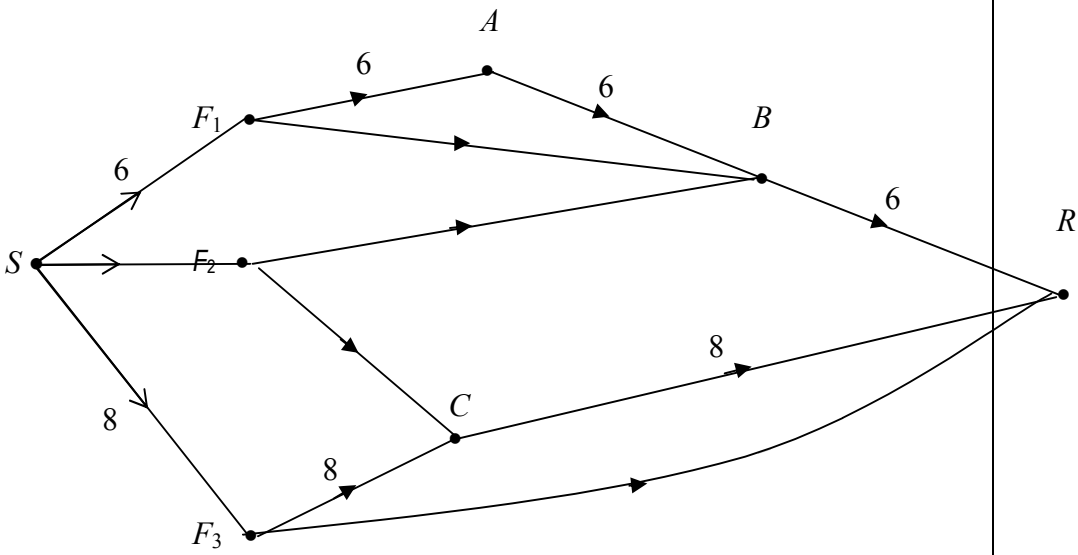
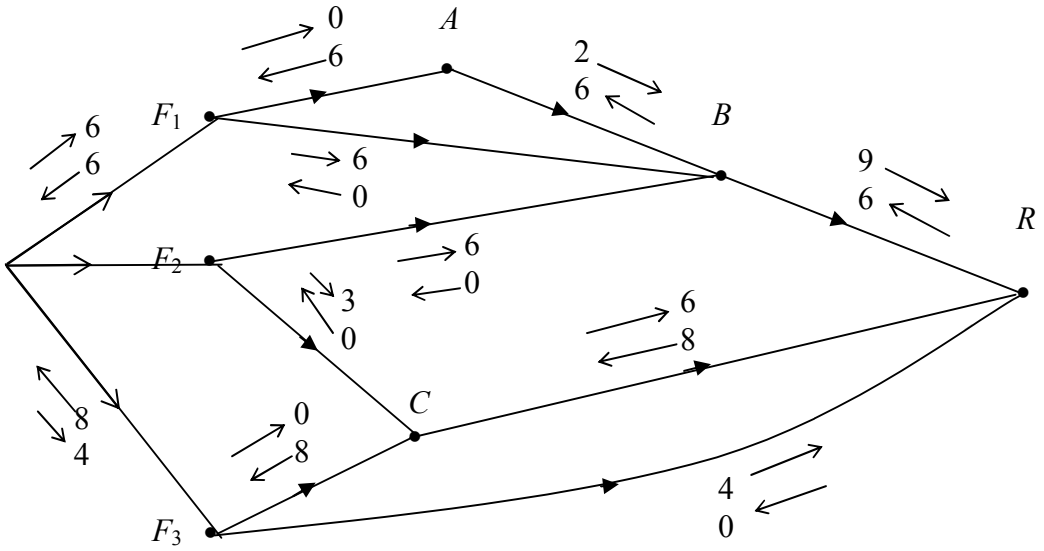
But the second row would then be the same as the first row above, and the solution thereafter would be the same. — A1 **(3)**

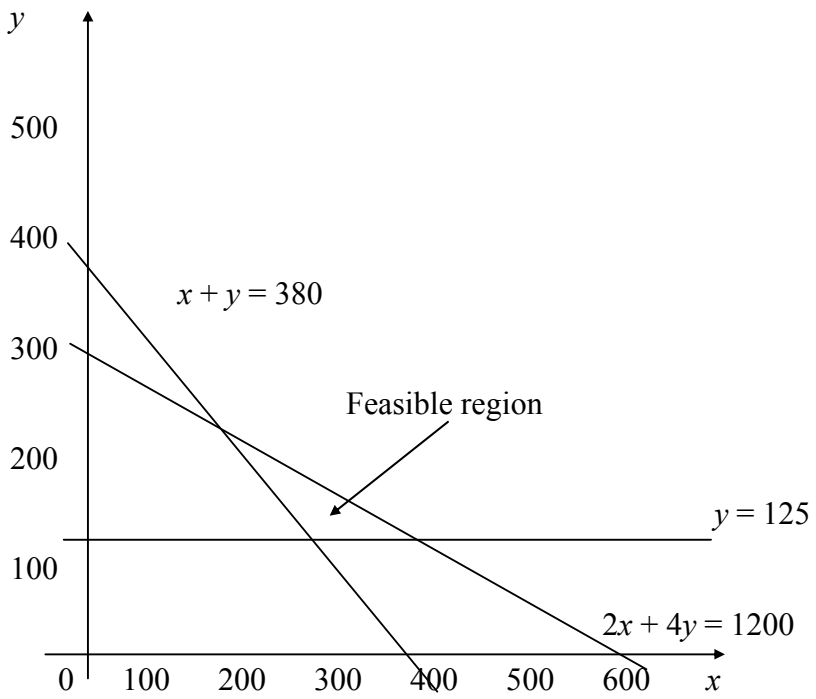
(*c*) Finds the H.C.F of *a* and *b*. — B1 **(1)**

(11 marks)

Question Number	Scheme	Marks
6. (*a*)	Critical activities *B*, *F*, *J*, *K*, *N* (not *I*); length 25 hours	B1; B1 **(2)**
(*b*)	$A = 5 - 0 - 3 = 2$ $E = 9 - 3 - 4 = 2$ $L = 22 - 11 - 4 = 7$ $C = 9 - 0 - 6 = 3$ $G = 9 - 4 - 3 = 2$ $M = 22 - 16 - 2 = 4$ $D = 11 - 3 - 3 = 5$ $H = 16 - 7 - 7 = 2$ $P = 25 - 18 - 3 = 4$ $I = 16 - 9 - 5 = 2$	M1 A1 ft A1 **(3)**
(*c*)		M1 A1 A1 ft A1 ft
(*d*)		M1 A1
	3 workers needed	A1 **(3)**
	Precedences: 	**(12 marks)**

ft = follow through mark

Question Number	Scheme	Marks
7. (*a*)		M1 A1 **(2)**
(*b*) (i)	$SF_1ABR = 6$	B1
(ii)	$SF_3CR = 8$	B1 **(2)**
		
(*c*)(i)		M1 A1
	e.g. $SF_1BR = 6$, $SF_2BR = 3$, $SF_2CR = 3$, $SF_3R = 4$	A1 A1
	Total flow = 30	A1 **(5)**
(ii)	Max flow – min cut theorem	M1
	Cut BR, F_2C, F_3C, F_3R	A1 **(2)**
		(11 marks)

Question Number	Scheme	Marks
8. (*a*)	$x + y \geq 380$	B1
	$y \geq 125$	B1
	$2x + 4y \leq 1200$	B1 **(3)**
(*b*)	$c = 3x + 2y$	B1 **(1)**
(*c*)		B1 B1 B1 B1 **(4)**
	Use of profit line or points testing	M1
	Minimum intersection of $x + y = 380$ and $2x + 4y = 1200$	
	$x = 160$, $y = 120$, cost = £920	A1 A1 **(3)**
(*d*)	Maximum at intersection of $y = 125$ and $2x + 4y = 1200$	M1
	$x = 350$, $y = 125$, cost = £1300	A1 A1 **(3)**
		(14 marks)