**EDEXCEL 6689 DECISION MATHEMATICS D1 JANUARY 2004 MARK SCHEME**

| Question | Mark Scheme | Marks |
|---|---|---|
| **1. (a)** | A graph consisting of two distinct sets of vertices X and Y in which… arcs can only join a vertex in X to a vertex in Y. | B1<br>B1<br>(2) |
| **(b)** | A path from an unmatched vertex in X to an unmatched vertex in Y…<br>..which alternately uses arcs in/not in the matching. | B1<br>B1<br>(2) |
| **(c)** | The (1-1) matching / pairing of some elements of X with elements of Y. | B1 |
| **(d)** | A 1-1 matching between all elements of X onto Y | B1<br>(2)<br>**(6)** |
| **2. (a)** | Yes, there are no negative values in the profit row | B1<br>(1) |
| **(b)** | $p = 63,\ x = 0,\ y = 7,\ z = 0,\ r = \frac{9}{2,},\ s = \frac{2}{3},\ t = 0$ | M1, A1, A1,<br>(3) |
| **(c)** | $\frac{63}{7} = 9$ | M1, A1<br>(2)<br>**(6)** |

| Question | Mark Scheme | Marks |
|---|---|---|
| **3. (a)** | $C_1 = 7 + 14 + 0 + 14 = 35$ | B1 |
| | $C_2 = 7 + 14 + 5 = 26$ | B1 |
| | $C_3 = 8 + 9 + 6 + 8 = 31$ | B1 (3) |
| **(b)** | Either Min cut = Max flow and we have a flow of 26 and a cut of 26<br>or C2 is through saturated arcs | B1 (1) |
| **(c)** | Using EJ (capacity 5) e. g – will increase flow by 1– ie increase it to 27 since only one more unit can leave E.<br>- BEJL - 1 | M1<br>A1 |
| | Using FH (capacity 3) e. g.– will increase flow by 2 – ie increase it to 28 since only two more units can leave F.<br>- BFHJL - 2 | |
| | Thus choose option 2 add FH capacity 3. | A1 (3) |
| | | **(7)** |
| **4. (a)** | BD + FG = 1.3 + 0.9 = 2.2 * | M1 |
| | BF + DG = 1.5 + (1.3 + 0.7) = 3.5 | A1 |
| | BG + DF = 0.7 + (0.9 + 0.8) = 2.4 | A1 |
| | Repeat BD and FG | (3) |
| | Route e.g. GABC<u>DB</u>FEDBG<u>FG</u> | B1 |
| | Length = 8.9 + 2.2 = 11.1 km | M1 A1 (3) |
| **(b)** | Only now need to repeat BF of length 1.5 < 2.2 | M1 A1 √ |
| | Length = 8.9 +1.5 = 10.4 km saving 0.7 (km ) | A1 √ (3) |
| | | **(9)** |

| Question | Mark Scheme | Marks |
|---|---|---|
| **5. (a)** | | |

| a | b | c | Integer? | Output list | a = b? |
|---|---|---|---|---|---|
| 90 | 2 | 45 | Yes | 2 | No |
| 45 | 2 | 22.5 | No | | |
| 45 | 3 | 15 | Yes | 3 | No |
| 15 | 2 | 7.5 | No | | |
| 15 | 3 | 5 | Yes | 3 | No |
| 5 | 2 | 2.5 | No | | |
| 5 | 3 | $1\frac{2}{3}$ | No | | |
| 5 | 5 | 1 | Yes | 5 | Yes |

M1
A1
A1 √
M1
A1
M1

Output list: 2,3,3,5 — A1√ (7)

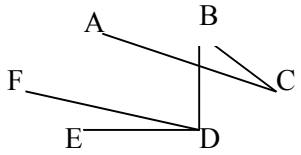
**(b)** Gives the prime factorisation of a — B2, 1, 0 (2)

**(c)** C = 1 — B1 (1)

**(10)**

**6. (a)** *See overlay* — B1 B1 (2)

**(b)** BD, $\left(\frac{AC}{DF}\right)$, BC, Not CD, DE




M1
A1, A1
B1

Length = 18 km — B1 (5)

**(c)** DB, DF, BC, CA, DE [5,2,4,1,6,3,] — M1 A1 A1 (3)

**(10)**

| Question | Mark Scheme | Marks |
|---|---|---|
| **7. (a)** | *See overlay* | B5, 4, 3, 2, 1, 0 (5) |
| **(b)** | Either point testing or profit line | M1 |
| | A $(3\frac{5}{6},3\frac{1}{2}) \to 25\frac{1}{6}$, B $(8\frac{1}{2},3\frac{1}{2}) \to 34\frac{1}{2}$, *Accept* C $(4,8) \to 48$ *and* D $(3,6) \to 36$ | |
| | Profit line gradient $-\frac{2}{5}$ | A1 |
| | Identifies A $(3\frac{5}{6},3\frac{1}{2})$ cost $25\frac{1}{6}$ | A1, A1 (4) |
| **(c)** | Either point testing or profit line | M1 |
| | *A* $(3\frac{5}{6}, 3\frac{1}{2}) \to$ not integer so try $(4,4) \to 20$ Profit line<br>*B* $(8\frac{1}{2}, 3\frac{1}{2}) \to$ not integer so try $(8,4) \to 32$<br>$\to$ try $(7,5) \to 31$ gradient $-\frac{3}{2}$ | |
| | Accept C $(4,8) \to 28$ *and* D $(3,6) \to 21$ | A1 |
| | Identifies (8,4) profit 32. | A1 A1 (4) **(13)** |
| **8. (a)** | $x = 0,\ y = 7, z = 9$ | B1, B1, B1, (3) |
| **(b)** | Length = 22, critical activities B D E L | B1, B1, (2) |
| **(c) (i)** | Float on N = 22 – 14 – 3 = 5 | B1 |
| **(ii)** | Float on H = 16 – 5 – 3 = 8 | M1 A1 (3) |
| **(d)** | *See overlay* | B4, 3,2,1,0 (4) |
| **(e)** | Attempt at 1. e.t. and e.e.t.<br>22 hours | M1<br>A1 (2) **(14)** |