6689 Decision Mathematics D1 – January 2001

1. (*b*) 46

2. (*b*) 4

3. (*a*) *AFEDEGDCBACGFA* (*b*) 840 m

4. (*c*) *A* = Wed, *B* = Fri, *C* = Mon, *D* = Tue, *E* = Thur

5. (*a*) 23, 23 (*b*) *A*, *D*, *G*, *H*, *K* ; 23

6. (*a*) (i) 5 (ii) 4 (iii) 3

7. (*b*)

Basic Var	*x*	*y*	*r*	*s*	Value	
r	1	2	1	0	70	←
s	3	2	0	1	90	
p	–30	–40	0	0	0	
		↑				

(*c*) $x = 10,\ y = 30, P = 1500$ (*d*) $x = 10,\ y = 30$

(*e*) Initial tableau relates to *O*
Second tableau relates to *A*
Third tableau relates to *C*

6689 Decision Mathematics D1 – June 2001

2. (*a*) *GC, FD, FG; DE, BC, GA*
(*b*) £214 000

3. *AGBCDEFCFGBA*

4. (*b*) *SCFET* 38 km

5. (*b*) 3.96; 4 tapes

6. (*b*) (i) 6 (ii) 10

7. (*c*) maximum profit = £15

6689 Decision Mathematics D1 – January 2002

2. (ii) 10

3. (i) (*b*) 38 (ii) (*a*) 6

4. (*a*) 13

5. (*a*) $5x + y \geq 10$, $x + y \geq 6$, $x + 4y \geq 12$, $x \geq 0$, $y \geq 0$

(*d*) (4, 2), $T = 14$

6. (*b*) (i) 6 (ii) 11

7. (*b*) 21 (*c*) $B - 1$, $D - 1$, $E - 2$, $G - 4$ (*e*) 24 days

6689 Decision Mathematics D1 – June 2002

1. *(a)* Datchet, Wraysbury, Staines, Feltham, Halliford, Ashford, Poyle, Colnbrook, Laleham.

2. *(b)* $P = 11$; $x = 1$; $y = \frac{1}{3}$; $z = 0$; $r = \frac{2}{3}$; $s = 0$; $t = 0$

(c) $P = 11 - z - s - t$

3. *(a)* 1–*C*, 2–*B*, 3–*A*, 4–*E*, 5–*D* and 1–*C*, 2–*A*, 3–*D*, 4–*B*, 5–*E*

(b) $2–B = 4–C = 1–E$; $2–D = 5–E$

4. *(a)* *A B F E H I*; 22 km *(b)* (i) *AB, BF, FE, EH, HI*

(ii) $\underline{A\,\overline{B}}\;\underline{F\,B}\;\underline{\overline{E}\,F}\;G\;I\;\underline{F\,\overline{E}}\;\underline{\overline{H}\,I}\;\underline{\overline{H}\,E}\;C\;D\;A\;C\;\underline{\overline{B}\,A}$

(iii) 113km

6. *(a)* *B, F, J, K, N* (not *I*); 25 hours

(b) $A = 2$; $C = 3$; $D = 5$; $E = 2$; $G = 2$; $H = 2$; $I = 2$; $L = 7$; $M = 4$; $P = 4$

(c) 3

7. *(b)* (i) 6; 8

(c) (i) $SF_1BR–6$; $SF_2BR–3$; $SF_2CR–3$; $SF_3R–4$.

Total flow = 30

8. *(a)* $x + y \geq 380$; $y \geq 125$; $2x + 4y \leq 1200$; $x \geq 0$

(b) $C = 3x + 2y$ *(c)* $x = 160$; $y = 220$; Cost = £920

(d) $x = 350$; $y = 125$; Cost = £1300

6689 Decision Mathematics D1 – November 2002

1. (*a*) (*A*, *X*, *D*, *V*), *C*, *W*, *B*, *Y*, *A*

3. (b) *A* – *W*, *G* – *F*, *J* – *C*, *L* – *S*, *N* – *O* or
A – *C*, *G* – *F*, *J* – *S*, *L* – *W*, *N* – *O*

4. (*a*) *CG* and *FH* (*b*) *G*; 144

5. (a) *SAGCT*; 82 (*b*) *SBFHT*; 84

6. (*b*) 5 bins

7. (*a*) *A*, *E* and *G* (*b*) 45
(*c*) *EHD* – 2, *ECHD* – 1 (*d*) max flow = 48

8. (*a*) Maximise $P = 4x + 5y + 3z$ subject to $3x + 2y + 4z \leq 35$,
$x + 3y + 2z \leq 20$, $4x + 5y + 3z \leq 24$
(*b*) $P = 47\frac{1}{4}$, $x = 11\frac{1}{2}$, $y = \frac{1}{4}$, $z = 0$
(*c*) Processing and packing

6689 Decision Mathematics D1 – January 2003

3. $c = 20x + 26y + 36z$

4. (*b*) $BA + AE = 17 + x$, $BD + DE = 2x + 9$, $BC + CE = 21$
(*c*) $0 < x < 6$ (*d*) 89 minutes

5. (*a*) $x = 31$, $y = 17$

8. (*a*)
$$2x + 3y + 4 \leq 8$$
$$x + 3y + z \leq 10$$
$$p = 8x + 9y + 5z$$

(*c*) $p = 28$, $x = 2$, $y = \frac{4}{3}$, $z = 0$, $r = 0$, $s = 0$

£11 100

6689 Decision Mathematics D1 – June 2003

1. $A = 1$, $B = 3$, C = 2, $D = 6$, $E = 4$, $F = 1$

2. (*b*) $x = 12$

3. (*a*) (ii) *EF*, *AC*, *BD*, *BA*, *EG*, *BE*

5. (*b*) *A*, *C*, *G*, *H*, *J*, *K*, *L* (*c*) 4 (*d*) 3 workers

(*e*) 89

6. (*a*) $300x + 500y$

(*b*) Finishing: $7x + 8y \leq 112$
Packing: $x + 2y \leq 20$

(*e*) Oxford = 6,York = 7; profit = £5 300

(*f*) Line $3.5x + 4y = 49$ passes through (6, 7) so reduce finishing time by 7 hours

7. (*b*) $x = 16$; $y = 7$ (*c*) $C_1 = 86$; $C_2 = 81$ (*e*) 75

6689 Decision Mathematics D1 – November 2003

1. (*b*) *CECAEFEAFABFBACDBDGFGDC*; Length = 12 km

3. (*b*) $A = 1$; $B = 2$; $C = 4$; $D = 3$; $E = 5$; $F = 6$

4. (*b*) $x \geq 2$

5. (*a*) Total Cost = £15; Wastage = 110 cm (*b*) £11

6. (*c*) *BH*, *NF*, *HN*, *NA*, *BE*, *NC*; length = 48

(*d*) new cable = 390 m

7. (*a*) $x = 3$, $y = 26$ (*d*) max flow = 82

8. (*a*) $x + 2y + 4z \leq 24$ (*b*) (i) $x + 2y + 4z + s = 24$

(*c*) 1 Euro

(*d*) Profit = 31 Euros; $y = 7$, $z = 2.5$, $x = r = s = 0$

(*e*) Cannot make half a lamp

(*f*) e.g. (0, 10, 0) or (0, 6, 3) or (1, 7, 2)

6689 Decision Mathematics D1 – January 2004

2. (*b*) $p = 63$, $x = 0$, $y = 7$, $z = 0$, $r = \frac{9}{2}$, $s = \frac{2}{3}$, $t = 0$ (*c*) 9

3. (a) $C_1 = 35$, $C_2 = 26$, $C_3 = 31$

4. (*a*) *GABCDBFEDBGFG*; Length = 11.1 km

5. (*a*) output list: 2, 3, 3, 5 (*b*) prime factorisation of *a* (*c*) $c = 1$

6. (*a*) *BD*, $\left(\frac{AC}{DF}\right)$, *BC*, Not *CD*, *DE*; Length = 18 km
(*c*) *DB*, *DF*, *BC*, *CA*, *DE* [5, 2, 4, 1, 6, 3]

7. (*b*) $x = 3\frac{5}{6}$ $y = 3\frac{1}{2}$ $C = 25\frac{1}{6}$ (*c*) $x = 8$ $y = 4$ $P = 32$

8. (*a*) $x = 0$, $y = 7$, $z = 9$ (*b*) Length = 22, *B D E L* (*c*) (i) 5; (ii) 8 (e) 22 hours

6689 Decision Mathematics D1 – June 2004

2. (*a*) 37 minutes (*c*) *S* – *C* – *E* – *G* – *T* 39 minutes

3. (*c*) Not unique e.g gives other solution (
(*e*) DF is the shortest so Start/Finish at A/B

4. (*a*) list not in alphabetical order

5. (*a*) $x = 9$, $y = 16$ (*b*) Initial flow = 53 (*c*) max flow – 64

6. (*a*) $4x \geq y$; $3x \leq 2y$ (*c*) (100, 400); Profit = £190

7. (*c*) *B*, *C*, *E*, *F*, *I*, *J*, *L* (*f*) 4 workers needed

6689 Decision Mathematics D1 – November 2004

1. (*a*) $x = 11$; $y = 5$; $z = 12$ (*b*) Flow is 31

3. (*b*) $A = 5$; $B = 1$; $C = 2$; $E = 6$; $F = 4$

4. (*c*) 73 has been located as the 10^{th} value

5. (*a*) $FAB_2ACEAEFDB_1DHGDG$F; Length = 185 km
(*b*) 47 km

6. (*a*) Via A – *HEAG*; length = $165 + 5x$;
Via B – *HECBG*; length = $265 + 2x$

(*b*) $0 \leq x < 33\frac{1}{3}$

7. (*a*) maximum P = $0.4x + 0.2y$
$x \leq 6.5$; $y \leq 8$; $x + y \leq 12$; $y \leq 4x$; $y \geq 0$

(*b*) 6500 type *x*, 5500 type *y* (*c*) £3700

8. (*a*) $x = 12$; $y = 24$, $z = 19$

(*b*) Allows *J* and *K* to be given a unique representation using events

(c) $F - E - I - J$
$G - H$ ⟋

(*d*) No effect, *B* has a total float of 2

(*g*) 10 extra hours ∴£280

6689 Decision Mathematics D1 – January 2005

1. (*b*) $A = 1$, $D = 5$, $J = 4$, $P = 6$, $S = 3$, $T = 2$

2. (*a*) *D* depends on *A* and *C*, but *E* depends on *A* only
H depends on *G* only, but *J* and *K* depends on *G* and *I*

3. (*a*) (i) *FH*, *AD*, *DE*, CE, *BC*/*EG*,(not *AC*), *CF*, *HI*, (not *FI*), *IJ*
(ii) *AD*, *DE*, *EC*, *BC*/*EG*, *CF*, *FH*, *HI*, *IJ*

(*b*) Start off the tree with *AB* and *FI* then apply Kruskal

4. 5 bins needed, therefore optional

5. (i) 385 m (ii) 1481 m

6. (*a*) (i) 8 (ii) 11 (iii) 9 (*c*) (i) max flow = 40

7. (*c*) The solution found after one iteration has a stack of 10 units of black per day

(*d*) (ii) Not optional, a negative value in profit row

(iii) $x = 0$, $y = 16\frac{2}{3}$, $z = 6\frac{2}{3}$,
$P =$ £1733.33, $r = 0$, $s = 0$, $t = 10$

6689 Decision Mathematics D1 – June 2005

2. (*a*) *AEBFCDA*

3. (*a*) length = 94 km
(*b*) Shortest arc is *CD* (7) so use *A* and *F* as end points

5. (*a*) $A = 3, B = 2, C = 5, D = 1, E = 4$;
$A = 1, B = 2, C = 5, D = 3, E = 4$.

6. (*a*) *ACFEGJ*; length = 53 km

(*c*) *ADFEGJ* or *ACEGJ*; length = 54 km

7. (*c*) $x = 0, y = 0, z = 14, r = 0, s = 4, t = 18, p = £91$

(*d*) $P - 90x - 25y + 65r = 9100$

(*e*) $P = 9100 + 90x + 25y - 65r$; so increasing x or y increases the profit

(*f*) the $\frac{2}{5}$ in the x column and 2nd (*s*) row

6689 Decision Mathematics D1 – January 2006

1. (*b*) $A = 6, B = 4, C = 1, D = 2, E = 3, F = 5$

2. (*a*) weight = 337m

(*b*) *ABFBGCACDEFDA*; length = 982m

3. (*b*) output: 1, 1, 2, 3, 5

4. (*b*) $C_1 = 1038$; $C_2 = 673$ (*d*) *AC*, *CD*, *GF*, *FT*

(*e*) Value of increased flow = 759

5. (*b*) A C I M; length = 26

(*d*) 5 workers needed

6. (*a*) $3x + 10 \leq 3000$
$3x + 2y \leq 1200$
$x \geq 2y$
$x, y \geq 0$

(*c*) (300, 150); profit = £67.50

(*d*) Production of stickers should be increased since this would move the intersection point further from the origin.

(*e*) The constraint lines would be far outside the feasible region so they would not affect it.

6689 Decision Mathematics D1 – June 2006

2. (*b*) $A = P$; $D = K$; $H = Y$; $M = C$; $R = B$; $S = F$

3. (*a*) *AD*, *DE*, *CF*, *FG* (b) 471 km

4. (*b*) *ABDFGI*; length = 108 miles

(*d*) *ABEDFGI*; length = 118 miles

5. (*c*) $D = 2$; $F = 8$

(e) Day 15: *C*; Day 25: *G*, *H*, *E*, *F*

6. (*a*) $7x + 10y + 10z + r = 3600$
$6x + 9y + 12z + s = 3600$
$2x + 3y + 4z + t = 2400$
$P - 35x - 55y - 60z = 0$

(*c*) $p = 20400$; $x = 0$; $y = 240$ $z = 120$; $r = 0$ $s = 0$ $t = 1200$

7. (*c*) $x = 0$, $y = 0$, $z = 14$, $r = 0$, $s = 4$, $t = 18$, $p = £91$

(*d*) $P - 90x - 25y + 65r = 9100$

(*e*) $P = 9100 + 90x + 25y - 65r$; so increasing x or y increases the profit

(*f*) the $\frac{2}{5}$ in the x column and 2nd (*s*) row

6689 Decision Mathematics D1 – January 2007

2. (*a*) $G - 3 = J - 4 = L - 5$;
improved matching: $E = 2$, $G = 3$, $J = 4$, $L = 5$

(*c*) $Y - 3 = G - 2 = E - 4 = J - 1$;
complete matching: $E = 4$, $G = 2$, $J = 1$, $L = 5$, $Y = 3$

3. (*a*) Bipartite graph (*b*) (A, 3, B) 4, C, 1, D, 2, A

(*c*) The graph is *not* planar

4.

(*a*)

b.v	x	y	z	r	s	value	Row ops
z	$\frac{1}{2}$	0	1	$\frac{1}{4}$	0	20	$(R_1 \div 4)$
s	0	4	0	$-\frac{1}{2}$	1	120	$R_2 - 2R_1$
P	8	–8	0	5	0	400	$R_3 + 20R_1$

(*b*) $P + 8x - 8y + 5r = 400$

(*c*) Not optimal, since there is a negative number in the profit row

5. (*b*) *CA*, *AD* and *FH* (*c*) 4600 m

6. (*c*) 5, 0 and 16 (*e*) 3 workers

7. (*c*) $2x + 3y \geq 24$, $x \leq 2y$ (*e*) (i) 8, (ii) 19

8. (*b*) 7 (*d*) 124

6689 Decision Mathematics D1 – June 2007

3. (*a*) $A = 3402$ (*b*) The product xy

4. (*a*) 164 km

5. (*b*) *MB*, *BE*, *MD*, *DC*, *CA* (*c*) 860

7. (*a*) $P - 2x - 4y - 3z = 0$

(*b*) $12x + 4y + 5z \leq 146$, $9x + 6y + 3z \leq 153$, $5x + 2y - 2z \leq 171$

(*d*) $P = 150$, $x = 0$, $r = 0$, $y = 1.5$, $s = 0$, $z = 48$, $t = 264$

8. (*a*) 85 (*b*) $c_1 = 140$, $c_2 = 104$

6689 Decision Mathematics D1 – January 2008

1. $A = 1$, $B = 4$, $C = 5$, $D = 3$, $E = 2$

2. (*c*) 107 m

3. (*a*) e.g. *ACDCFGFDGEDAEBA*, 12.3 km (*b*) (ii) 22 km

4. (*b*) $D = 4$, $G = 7$, $I = 2$ (*c*) *B*, *E*, *J*, *M*

(*d*) 2.914, $\therefore$ 3 workers

6. (*e*) 67

7. (*a*) $y \geq 2x$ (*d*) 70 boxes (*e*) $1.2 + 1.4y$

(*f*) (32, 64) (*g*) £128

6689 Decision Mathematics D1 – June 2008

1. (*a*) 6 tapes

2. (*a*) G = 5 – W = 3 (*b*) A – no match, E – 2, G – 5, R – 4, W – 3
(*c*) A = 2, E = 3,G = 5, R = 1, W = 4

3. (*a*) ADGHI, 48 km
(*b*) e.g. ADGHGDACEDHIFHEFBA, 233 km

5. (*a*) $x = 9, y = 11$ (*b*) AC DC DT ET (*c*) 36
(*d*) $C_1 = 49$, $C_2 = 8$, $C_3 = 39$ (*e*) e.g. SAECT

7. (*a*) $v = 16, w = 25, x = 23, y = 20, z = 8$ (*b*) BCGLMQ
(*c*) H = 1, J = 1 (*f*) 4 workers needed

8. $P = 0.2 + 0.15b$
(subject to $a + b \le 800$, $a \ge 2b$, $50 \le b \le 100$, $a \ge 0$)

6689 Decision Mathematics D1 – January 2009

1. (*b*) Not on list

4. (*a*) $A = 5$, $B = 3$, $C = 2$, $D = 1$, $E = 6$, $F =$ unmatched
(*c*) $A = 5$, $B = 3$, $C = 4$, $D = 2$, $E = 1$, $F = 6$

5. (*a*) 579 km (*b*) start and finish at D and G

6. (*a*) A B C E G H 156 km
(*b*) A B E G H 165 km

7. (*b*) (i) (0, 80); value = 80 (ii) (24, 96); value = 168

8. (*b*) A I K M N length 39
(*c*) Float on F is 4; Float on G is 6
(*e*) e.g. At time $14\frac{1}{2}$ there are 4 tasks; I, E, H and C must be happening

6689 Decision Mathematics D1 – June 2009

1. (*a*) AD, AE, DB; DC, CF (*c*) Weight 595 (km)

2. (*a*) 4 (*b*) Bin 1: 32 17 9 (*c*) e.g. Bin 1: 32 28
Bin 2: 45 12 Bin 2: 38 12 10
Bin 3: 23 28 Bin 3: 45 9
Bin 4: 38 16 Bin 4: 23 17 16
Bin 5: 10

3. (*a*) H – 2 = M – 5 = R – 4
(*b*) C = 6 E = 5 H = 1 M = 2 R = 4 S = 3

5. (*a*) 707 (m) (*b*) C

6. (*a*) A E H I (*b*) 28 km

7. (*a*) $7x + 5y \leq 350$ (*d*) $2x + 3y$
(*e*) optimal point in R is (35, 20); Profit (£)130

8. (*b*) A C J L (*c*) Total Float for M = 1; Total float for H = 14
(*d*) 1 p.m., day 16: C 1 p.m., day 31: C F G H

6689 Decision Mathematics D1 – January 2010

1. (*a*) A–1, C–3, D–4, E–5
(*b*) A–1, B–3, C–6, D–5, E–2, F–4

2. (*c*) Total length = 440 miles

3. (*a*) Route ADEGH, 36 minutes
(*b*) Shortest time = 207 minutes

4. (*b*) 4; 4; 3.2, 0.6; 2.6, 1.0, 0.4; 2.5, 0.5, 0.3
(*c*) Yes

5. (*a*) S: 25000; T: 0, 3400, 4450; R: 17000, 7000, –5000;
R > 0?: yes, yes, no; Output: 4450
(*b*) £4450 (*c*) £8000

6. (*d*) B, E, G, H; 16 days

7. (*a*) $x + 2y \leq 12$
(*f*) 6 standard cupboards, 3 large cupboards

6689 Decision Mathematics D1 – June 2010

2. (*b*)

	A	B	C	D	E	F	G	H
A	-	31	30	-	-	-	-	-
B	31	-	-	**24**	-	-	-	38
C	30	-	-	**22**	24	**29**	-	-
D	-	**24**	**22**	-	18	-	-	**34**
E	-	-	24	18	-	28	**26**	-
F	-	-	**29**	-	28	-	21	-
G	-	-	-	-	**26**	21	-	**33**
H	-	38	-	**34**	-	-	**33**	-

(*c*) AC CD DE BD GE GF GH (*d*) Weight: 174

3. (*a*) 4 bins

(*b*) Bin 1: 41, bin 2: 28+31, bin 3: 42, bin 4: 36, bin 5: 32, bin 6: 29

(*c*) Full bins: 28 +32, 31 + 29

4. (*a*) BA, AC and EG (*b*) e.g. ACFGDCABDEGEBA, 93.8 km

5. (*a*) A = 4, C unmatched, E = 2, G = 3, J = 5, S = 6

(*b*) A = 2, C = 5, E = 6, G = 3, J = 4, S = 1

6. (*a*) SBEFHT, 87 mins (*c*) EFHT

7. (*c*) $C = 500x + 800y$ (*d*) (11, 7) at a cost of £11 100

8. (*b*) C E H J L (*d*) 4 workers needed

6689 Decision Mathematics D1 – January 2011

1. (*a*) 21 miles (*b*) **ABCEGFH** (*c*) **HFGEC**, 14 miles

2. (*a*) 4 discs

(*b*) Bin 1: 23 + 11 + 10
Bin 2: 29 + 14
Bin 3: 34
Bin 4: 35
Bin 5: 17

(*d*) Bin 1: 35 + 14
Bin 2: 34 + 11
Bin 3: 29 + 17
Bin 4: 23 + 10

3. (*a*) **CI CD EF FI** $\left\{\begin{matrix}\mathbf{BC}\\\mathbf{HI}\end{matrix}\right\}$ **GF AB**

(*b*) **AB BC CI CD FI IH FG** (*c*) Weight: £270

4. (*a*) Bipartite graph

(*b*) A = 2, B = 6, D unmatched, J = 3, K = 1, M = 5

(*c*) A = 6, B = 1, D = 2, J = 3, K = 4, M = 5

5. (*a*) e.g. **ABDGIGDDEIHFEACFEA**

(*b*) Roads **AE**, **EF**, **DG**, **GI** repeated; length = 41.3 km

(*c*) **A**

6. (*a*) $4y \geq x$, $2y \leq x + 30$ (*b*) (10, 20)

7. (*d*) Critical activities **AC** $\left\{\begin{matrix}\mathbf{FH}\\\mathbf{G}\end{matrix}\right\}$ J (*e*) 2 (*f*) 3

6689 Decision Mathematics D1 – June 2011

1. (*a*) not alphabetical (*b*) e.g. quick sort (*c*) Pivot 4 = 7 Kim

2. (*d*) no, two solutions

3. (*a*) $6x + 5y \leq 60$, $2x + 3y \geq 12$, $3x \geq 2y$, $x \leq 2y$

(*b*) $\left(\frac{120}{17}, \frac{60}{17}\right)$ (*c*) 24.7 (*d*) (6, 4)

4. (*a*) A – 1 = H – 2, A – 1 = H – 3 = R – 4 = C – 5

(*b*) A = 3, C = 5, H = 1, (J unmatched), R = 4

5. (*a*) AC, DG and GF (*b*) e.g. ADCACGDGFGECBEFBA

(*c*) 106 km

6. (*a*) ACDFEGH, 71 km (*c*) ACBEGH, 72 km

7. (*c*) B D J H L

8. Maximise $P = 15x + 12y$ subject to $x \geq 50$, $\frac{1}{5}(x + y) < x$, $\frac{2}{5}(x + y) > x$, $3x + 2y \leq 200$, $y \geq 0$

6689 Decision Mathematics D1 – January 2012

1. (*d*) 148 km

2. (*a*) 154 discs (*b*) Increase

3. (*a*) **C** = 3, **E** = 2, **G** = 1, **H** = 6, **J** = 4, (**S** unmatched)

(*b*) **C** = 2, **E** = 5, **G** = 1, **H** = 3, **J** = 4, **S** =6

4. (*a*) **ACHFIJ**, 114 minutes (*b*) **ABEGIJ**, 115 minutes

5. (*a*)

Bin 1: 5, 1, 8, 5	Bin 4: 8, 12
Bin 2: 13, 2	Bin 5: 15
Bin 3: 16	

(*c*)

Bin 1: 16, 2, 1	Bin 4: 12, 8
Bin 2: 15, 5	Bin 5: 10, 8
Bin 3: 13, 5	

(*d*) 5 bins needed

6. (*a*) At least 40 apples trees, at least 50 plum tress

(*c*) P = 60*x* + 20*y* (*d*) (72, 36) (*e*) £5040

7. (*c*) Total float on D = 7, total float on G = 6

(*d*) 3 workers

6689 Decision Mathematics D1 – June 2012

1. (*a*) 5 bins
(*b*) Bin 1: 20, 19; Bin 2: 33; Bin 3: 24, 22; Bin 4: 31, 18; Bin 5: 27; Bin 6: 25
(*d*) Bin 1: 33; Bin 2: 31, 19; Bin 3: 27, 22; Bin 4: 25, 24; Bin 5: 20, 18

3. (*d*) 76 km

4. (*c*) 1641 m (*d*) e.g. DCFDAEBGEFKIFHJGHE

5. (*a*) SCFBDET; length 65 (*b*) SCFBET; length 68

6. (*c*) 13 (*d*) 3 workers

7. (*a*) $y \leq x$ (*c*) $5x + 6y \leq 300$
(*g*) 48 standard, 10 luxury cars; £4640 per week

6689 Decision Mathematics D1 – January 2013

1. (*a*) Output is R = 8.485 281 4
(*b*) Would get a negative output for R (*c*) E cannot be zero

2. (*b*) Maximum of 5 iterations is necessary

3. (*a*) (i) C–4, G–5, J–3, N–6, R–2 (ii) G–5, J–3, N–4, O–6, R–2
(*c*) C–5, G–1, J–3, N–4, O–6, R–2

4. (*b*) Shortest path: SBADET; length 40 miles
(*c*) Shortest distance S to F = 29 miles
(*d*) SADET or SCDET; length 41 miles

5. (*a*) AC (32) CF (14) DF (12) EF (17);
BE (15) FI (18); IJ (10) GJ (9) DH (19)
(*b*) £11 680 (*c*) Roads BE, EG and FH need repeating
(*d*) 443 km (*e*) Start B, finish G, route length = 404 km

6. (*a*) $5y \geq x$ (*b*) $2x + y \geq 70$, $4x + 5y \geq 200$
(*e*) $T = 10x + 4y$
(*f*) 20 celebration arrangements, 30 party arrangements, 320 mins

7. (*a*) Activity K depends on activities E, F and B, but activity I depends on F and B only
(*c*) Critical activities: A, F, I, L (*d*) Total float on G = 3
(*f*) Activities A, C and D must be happening at time 5.5
(*g*) 4 workers are needed

6689 Decision Mathematics D1 – June 2013

2. (*a*) Bin 1: 0.6, 0.2, 0.4, 0.5, 0.1; Bin 2: 1.5, 0.3;
Bin 3: 1.6; Bin 4: 0.7, 0.9
(*c*) Bin 1: 1.6, 0.4; Bin 2: 1.5, 0.5;
Bin 3: 0.9, 0.7, 0.3, 0.1; Bin 4: 0.6, 0.2
(*d*) Minimum of 4 bins needed

3. (*a*) AC, CD, CE; EF; BC
(*d*) EF, AC, CD, reject AD, CE, reject DE, CB (*e*) 40 days

4. (*a*) SADGEHT, 30 miles (*b*) SCBFEHT, 31 miles

5. (*a*) Repeat arcs AC, BC and DE
(*b*) e.g. ABCADCBEDFGDEGHECA; length 418
(*c*) Start at E and finish at A; length 382

6. (*d*) $100x + 300y$ (*e*) 54 2-seater and 36 4-seater, cost £16 200

7. (*b*) $M = 8$ (*d*) minimum 4 workers needed
(*c*)(i) no effect (*c*)(ii) 2 days late
(*f*) 5 workers needed (*g*) bound in (*f*) is better

6689 Decision Mathematics D1 – June 2013 (R)

1. (*a*) A = unmatched, B = 4, C = 5, D = 6, E = 1, F = 2
(*c*) A = 1, B = 3, C = 5, D = 2, E = 6, F = 4

2. (*a*) AB(85), BC(100), BD(135); BF(150), EF(140)
(*c*) 610 minutes

3. (*b*) 6 (*c*) 3 workers

4. (*b*) Pivot 4 = 7 Lydia

5. (*a*) repeat arcs AB, BF and GH
(*b*) e.g. ABCDBFDEHGFHGAFBA; length 227
(*c*) shortest is 15, e.g. repeat AF, use G and H as start and finish

7. (*b*) C_2EFGIJ; length 48

8. (*a*) $y \leq 16$; and $y \leq 2x$ (*b*) $4x + 3y \leq 120$ (*c*) $x \leq 3y$
(*e*) $P = 45x + 30y$ (*g*) £1320