2010 Further Mathematics Trial Exam 1 Solutions

SECTION A Core: Data analysis

1	2	3	4	5	6	7	8	9	10	11	12	13
C	A	E	C	D	D	E	A	B	E	E	D	A

SECTION B

Module 1: Number patterns and applications

1	2	3	4	5	6	7	8	9
A	A	C	E	D	A	E	C	C

Module 5: Networks and decision mathematics

1	2	3	4	5	6	7	8	9
E	D	C	D	A	A	E	D	E

Module 6: Matrices

1	2	3	4	5	6	7	8	9
B	C	D	E	D	A	C	C	B

SECTION A Core: Data analysis

Q1 From the stemplot the modal class is 35-39 has the highest percentage. C

Q2 From the stemplot
(females 80-84) + (males 80-84) + (females 85^+) + (males 85^+)
$\approx 1.1+0.8+1.1+0.5=3.5$ A

Q3 The stemplot shows the Australian population is aging. E

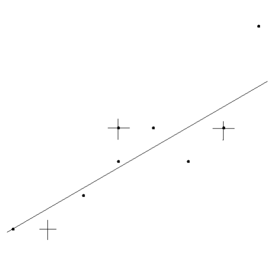
Q4 Find the gradient of the line joining the end points.
$\frac{2.9-1.9}{20}\times\text{million}=\frac{1}{20}\times\text{million}=50000$ C

Q5 The distribution peaked at the low end. D

Q6 The mid points of the intervals are 0, 8, 20, 29.5, 37, 40, 44.5 and 54.5.
$\text{Average}=\frac{1}{2210556}(0\times82495+8\times262884+20\times204850$
$+29.5\times214869+37\times368918+40\times439048+44.5\times252283$
$+54.5\times385209)\approx 34.4$ D

Q7 E

Q8 A



Q9 $\log_{10} y$ will straighten the graph. B

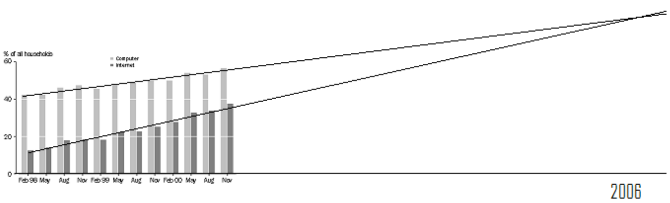
Q10 Random pattern. E

Q11 $\text{Seasonal index}=\frac{actual}{adjusted}=\frac{5.4}{5.2}\approx 1.04$ E

Q12 D

Nov		Dec		Jan		Feb		Mar
5.6		5.5		5.2		5.3		5.4
			5.4		5.35			
				5.38				

Q13 A



SECTION B

Module 1: Number patterns and applications

Q1 $1+3+6+10+15=35$ A

Q2 Difference between adjacent terms:
$483-240=243=3^5$
$240-159=81=3^4$
$159-132=27=3^3$
$132-t_2=3^2=9$, $\therefore t_2=123$
$123-t_1=3^1=3$, $\therefore t_1=120$ A

Q3 $t_1+t_2=t_3+t_4=......=-1$. There are 189 pairs not counting the last term.
The value of the series $=-1\times189+379=190$ C

Q4
$5+2(5\times0.9)+2(5\times0.9^2)+2(5\times0.9^3)+2(5\times0.9^4)+2(5\times0.9^5)$
≈ 42 E

Q5 $5+\frac{a}{1-r}=5+\frac{9}{1-0.9}=95$ D

Q6 $t_1=-2$, $t_2=\frac{1}{2}(10-^-2)=6$, $t_3=\frac{1}{2}(10-6)=2$,
$t_4=\frac{1}{2}(10-2)=4$, $t_5=\frac{1}{2}(10-4)=3$ A

Q7 E

Q8 $y_1 = 200$, $y_2 = 0.95 \times 200 + 50 = 240$
$y_3 = 0.95 \times 240 + 50 = 278$ C

Q9 $t_{n+1} = 0.95 t_n + 50$, $t_1 = 200$ C

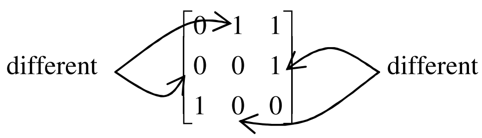
Module 5: Networks and decision mathematics

Q1 $v + f = e + 2 = 11 + 2 = 13$ E

Q2 D

Q3 C

Q4 D



Q5 One-step matrix is $\begin{bmatrix} 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$.

Two-step matrix is $\begin{bmatrix} 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}^2 = \begin{bmatrix} 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 2 & 1 & 1 \end{bmatrix}$. A

Q6 $16 + 9 + 12 = 37$ A

Q7 Maximum flow = minimum cut $= 21 + 12 = 33$ E

Q8 D

Q9 $2 + 5 + 10 + 8 = 25$ E

Module 6: Matrices

Q1 $\begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix} - 3\begin{bmatrix} -2 & a \\ b & 1 \end{bmatrix} = \begin{bmatrix} 8 & 2 \\ -2 & -3 \end{bmatrix}$

$\therefore -1 - 3a = 2$, $a = -1$ B

Q2 $\begin{bmatrix} 1 & b \\ a & -1 \end{bmatrix}\begin{bmatrix} -4 & b \\ b & 2 \end{bmatrix} = \begin{bmatrix} 0 & 3b \\ -2 & -4 \end{bmatrix}$

$\begin{bmatrix} -4 + b^2 & 3b \\ -4a - b & ab - 2 \end{bmatrix} = \begin{bmatrix} 0 & 3b \\ -2 & -4 \end{bmatrix}$

$\therefore -4 + b^2 = 0$, $-4a - b = -2$, $ab - 2 = -4$

$\therefore b = -2$ C

Q3 Inverse does not exist when the determinant is zero, i.e.

$3n + 2m = 0$, $\frac{m}{n} = -\frac{3}{2} = -1.5$ D

Q4 Change the system of equations to

$$1z + 0x + 1y = -2$$
$$3z + 0x - 1y = 0$$
$$0z + 1x - 2y = 3 .$$ E

Q5 D

Q6 A

Q7

$\begin{bmatrix} 0.80 & 0.30 \\ 0.20 & 0.70 \end{bmatrix}^n$ becomes $\begin{bmatrix} 0.60 & 0.60 \\ 0.40 & 0.40 \end{bmatrix}$ when n is large, i.e. in the long run the probability of drinking tea is 0.60.

Number of cups of tea in a year $= 365 \times 0.60 = 219$ C

Q8 C

$\begin{bmatrix} 0.90 & 0.10 & 0.05 \\ 0.08 & 0.85 & 0 \\ 0.02 & 0.05 & 0.95 \end{bmatrix}^2 \begin{bmatrix} 50 \\ 60 \\ 40 \end{bmatrix} = \begin{bmatrix} ... \\ 50.99 \\ ... \end{bmatrix}$

Q9 B

$\begin{bmatrix} 0.90 & 0.10 & 0.05 \\ 0.08 & 0.85 & 0 \\ 0.02 & 0.05 & 0.95 \end{bmatrix}^{-2} \begin{bmatrix} 50 \\ 60 \\ 40 \end{bmatrix} = \begin{bmatrix} ... \\ 74.08 \\ ... \end{bmatrix}$

Please inform mathline@itute.com re conceptual, mathematical and/or typing errors

