2013 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	B	B	E	A	A	D	B	C	E	B	D	E

SECTION B
Module 1: Number patterns

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

SECTION A Core: Data analysis

Q1 35-39 age group: $5000+4000=9000$
40-44 age group: $5000+3500=8500$
45-49 age group: $5000+3500=8500$
Total: $9000+8500+8500=26000$ C

Q2 Not D and E because 'young' is not defined. B

Q3 The 35-39 age group has the highest number of doctors. B

Q4 For the 26 students, the $IQR=74-57=17$.
For girls only, the $IQR=75-57=18$.
For boys only, the $IQR=72-60=12$. E

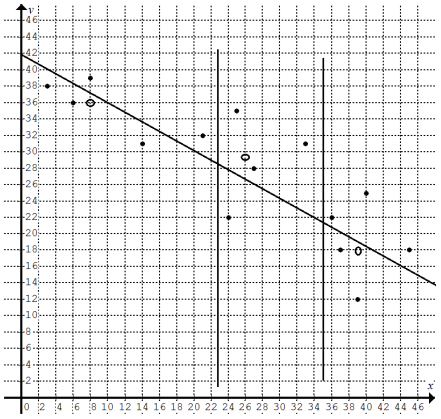
Q5 A

Q6 $2\sigma=376.5-375.5=1.0$, $\therefore\ \sigma=0.5$
$\therefore$ percentage of cans between 375 and 376 is 68%.
$\therefore$ percentage of cans between 375.2 and 375.8 is less than 68%. A

Q7 $z=\dfrac{x-\mu}{\sigma}=\dfrac{375.2-375.5}{0.5}=-0.6$ D

Q8 $m=r\times\dfrac{s_y}{s_x}=-0.395\times\dfrac{2}{1.58}=-0.5$,
$c=\bar{y}-m\bar{x}=1+0.5\times3=2.5$ B

Q9 C



Q10 $Gradient=\dfrac{36-18}{8-39}\approx-0.58$, $y\text{-}intercept\approx42$ E

Q11 B

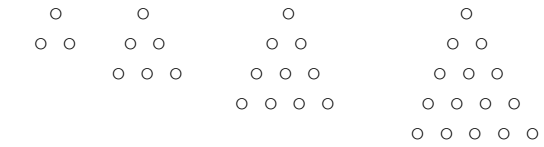
Q12
$$X=\frac{11895+8957+7761+13031+14422+6137+5226}{7}$$
$$\approx9633$$
$$\frac{5226+Y+10134+8927+15008+13678+7074}{7}=9718$$
$Y=7979$ D

Q13 *Total turnover of days 15, 16 and 17*
$=10205\times7-8927-15008-13678-7074=26748$ E

SECTION B
Module 1: Number patterns and applications

Q1 The nth term is n^2-2 $\therefore\ t_{15}=15^2-2=223$ D

Q2



$t_1=1$, $t_2=3$, $t_3=6$, $t_4=10$, $t_5=15$, … form a pattern.
$t_2=2^2-t_1$, $t_3=3^2-t_2$, etc.
$\therefore\ t_6=6^2-t_5=21$
$t_7=7^2-t_6=28$
$t_8=8^2-t_7=36$
$Total=1+3+6+10+15+21+28+36=120$ E

Q3 Read the sequence backwards. It is an arithmetic sequence.
$a=7.9$, $d=-0.8$, $n=10$
$S_{10}=\dfrac{10}{2}\times\left(2\times7.9+(10-1)\times-0.8\right)=43$ B

Q4 The original infinite geometric series: $S_\infty = \dfrac{12}{1-r} = 18$

$\therefore\ r = \dfrac{1}{3}$, $\therefore\ \dfrac{1}{3}b = 12$, $\therefore\ b = 36$

$\therefore$ the second infinite geometric series: $S_\infty = 36 + 18 = 54$ C

Q5

$t_1 + t_{15} = t_2 + t_{14} = t_3 + t_{13} = t_4 + t_{12} = t_5 + t_{11} = t_6 + t_{10} = t_7 + t_9 = 16$

$S_n = \dfrac{n}{2}(a + \ell)$, $S_{15} = \dfrac{15}{2} \times 16 = 120$ E

Q6 $1.055^3 \approx 1.174$, $\therefore$ increase by a factor of 0.174, i.e. 17.4%. C

Q7 $t_{n+1} + t_n = 2t_n - 1$, $t_2 = -1$.

$\therefore\ t_{n+1} = t_n - 1$

$\therefore\ t_3 = t_2 - 1 = -1 - 1 = -2$ and $t_4 = t_3 - 1 = -3$

The pattern : $t_n = 1 - n$

$\therefore\ t_{21} = -20$ A

Q8 $t_1 = 10$, $t_2 = -5$, $t_3 = 10$, $t_4 = -5$, ……

The pattern: $t_{n+1} = 5 - t_n$, or $t_n + t_{n+1} = 5$ E

Q9 $t_n + t_{n+1} + t_{n+2} = 2t_{n+2}$, $\therefore\ t_{n+2} = t_{n+1} + t_n$

$\therefore$ it is a Fibonacci sequence. C

Module 5: Networks and decision mathematics

Q1 $\dfrac{n(n-1)}{2} = 253$, $n = 23$ B

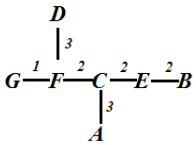
Q2 B

Q3 C

Q4 A

Q5 *GFEBDAC*, *GFCADBE*, *GCADBEF*, *GCADFEB*, *GCFEBDA* D

Q6 $1 + 2 + 2 + 2 + 3 + 3 = 13$ A



Q7 *ACEBDFG* $3 + 2 + 2 + 6 + 3 + 1 = 17$ C

Q8 Critical path: *BEJM* $3 + 15 + 4 + 3 = 25$ A

Q9 C

Module 6: Matrices

Q1 C

Q2 $X = \begin{bmatrix} 1 & x \\ 0 & -1 \end{bmatrix}$, $X^{-1} = \dfrac{1}{-1-0}\begin{bmatrix} -1 & -x \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & x \\ 0 & -1 \end{bmatrix}$ B

Q3 $C = B(A + 2X)$,

$\begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ 1 & -2 \end{bmatrix}\left(\begin{bmatrix} -2.8 & -1.2 \\ -0.4 & 0.4 \end{bmatrix} + 2\begin{bmatrix} 1 & x \\ 0 & -1 \end{bmatrix}\right)$.

Solve for $x = 0.5$ D

Q4 E

Q5 C

Q6 B

Q7 $\begin{bmatrix} 0.90 & 0.01 & 0.05 \\ 0.05 & 0.95 & 0.10 \\ 0.05 & 0.04 & 0.85 \end{bmatrix}\begin{bmatrix} 5200 \\ 4000 \\ 4800 \end{bmatrix} = \begin{bmatrix} 4960 \\ 4540 \\ 4500 \end{bmatrix}$ C

Q8

$\left(\begin{bmatrix} 0.90 & 0.01 & 0.05 \\ 0.05 & 0.95 & 0.10 \\ 0.05 & 0.04 & 0.85 \end{bmatrix}^{-1}\right)^2\begin{bmatrix} 5200 \\ 4000 \\ 4800 \end{bmatrix} \approx \begin{bmatrix} 5717.4 \\ 2665.3 \\ 5617.4 \end{bmatrix}$ D

Q9

$\begin{bmatrix} 0.90 & 0.01 & 0.05 \\ 0.05 & 0.95 & 0.10 \\ 0.05 & 0.04 & 0.85 \end{bmatrix}^n\begin{bmatrix} 5200 \\ 4000 \\ 4800 \end{bmatrix} \to \begin{bmatrix} 2390 \\ 8537 \\ 3073 \end{bmatrix}$ for large n.

$\dfrac{8537}{14000} \times 100\% \approx 61\%$ B

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

