2012 Further Mathematics Trial Exam 1 Solutions

SECTION A Core: Data analysis

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

SECTION B

Module 1: Number patterns and applications

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

SECTION A Core: Data analysis

Q1 $3+5+6+5+5+3+2+1=30$ B

Q2 D

Q3
$$\frac{5\times5+15\times7+25\times10+35\times10+45\times9+55\times9+65\times7+75\times2}{59}$$
≈ 37.88 B

Q4 $\text{Range}=89-33=56$, $\text{median}=\frac{68+69}{2}=68.5$ C

Q5 $IQR=Q_3-Q_1=74-57=17$
$Q_1-1.5\times IQR=57-25.5=31.5$ A

Q6 $\frac{0.5}{0.34+0.5}\approx 0.6=60\%$ C

Q7 $z=\frac{x-\mu}{\sigma}=\frac{8.4-6.0}{1.5}=1.60$ D

Q8 $\bar{y}=a+b\bar{x}=0+\frac{6}{8}\times 3.7\approx 2.8$ E

Q9 $\frac{s_y}{s_x}=\frac{b}{r}=\frac{\frac{6}{8}}{0.95}\approx 0.8$ E

Q10 B

Q11 B

Q12 A

Q13 $\text{Gradient}=\frac{5.5-3}{44-9}\approx 0.0714$ E

SECTION B

Module 1: Number patterns and applications

Q1 1, ***1***, 3, ***4***, 5, ***7***, 7, ***10***, 9, ***13***, 11, ***16***, 13, ***19***, 15, 22 E

Q2 Common difference of 4.2 D

Q3 $S_{13}=\frac{13}{2}(a+l)$, $3.25=\frac{13}{2}(a+l)$, $a+l=0.5$
$\therefore t_6+t_8=0.5$, $t_7=\frac{t_6+t_8}{2}=0.25$, $\therefore t_6+t_7+t_8=0.75$ C

Q4 $1.4\times r^3=-4.725$, $r=-1.5$, $1.4\times r+1.4\times r^2=1.05$ D

Q5 $t_1=1$, $t_2=3$, $t_3=5$, ……
$\therefore$ it is an arithmetic sequence, $d=2$, $t_7=1+(7-1)2=13$ C

Q6 Geometric sequence, $r=1-0.025=0.975$
$0.975^n<0.5$, $n>27.3779$, at least 28 weeks E

Q7 $t_{n+1}-2t_n=n(n+1)$, $t_1=3$, $t_2=8$, $t_3=22$, $t_4=56$
$t_5=132$ A

Q8 $f_{10}-10=f_{11}$, $f_{11}+f_{10}=f_{12}$, $f_{12}+f_{11}=12$
$\therefore f_{10}=f_{11}+10$, $f_{11}+f_{11}+10=f_{12}$, $\therefore f_{11}=\frac{f_{12}}{2}-5$
$\therefore f_{12}+\frac{f_{12}}{2}-5=12$, $\frac{3f_{12}}{2}=17$, $f_{12}=\frac{34}{3}\approx 11.3$ B

Q9 $A_{n+1}=(1+0.05)A_n-15000$, $A_{n+1}-A_n=0.05A_n-15000$
C

Module 5: Networks and decision mathematics

Q1 $\text{The minimum number of edges}=\frac{17\times16}{2}=136$ A

Q2 A

Q3 $V=E-F+2$. If F is odd, then V and E cannot be both even or both odd. The numbers do not add up for A. C

Q4 All the vertices are even for Graph III, an Euler path may start on any vertex. C

Q5 E

Q6 $27+21+22+17+21+19+26+21+29=203$ D

Q7

$$A=\begin{bmatrix}0&1&0&0\\1&0&2&0\\0&0&0&1\\1&1&0&0\end{bmatrix},\ A^2=\begin{bmatrix}1&0&2&0\\0&1&0&2\\1&1&0&0\\1&1&2&0\end{bmatrix}$$

Q can reach *P* and *R* using one-stage route, and *S* using two-stage route.
R can reach *P* and *Q* using two-stage route, and *S* using one-stage route.
S can reach *P* and *Q* using one/two-stage route, and *R* using two-stage route.

E

Q8 Minimum cut = 10 E

Q9 *D* can finish *Q* and *R* in 3 hours; *A* can finish *P* in 3 hours; *C* can finish *S* in 3 hours.

E

Q8

$$\left(\begin{bmatrix}0.95&0.015&0.005\\0.04&0.98&0.075\\0.01&0.005&0.92\end{bmatrix}^{-1}\right)^2\begin{bmatrix}0.58\\0.37\\0.05\end{bmatrix}\approx\begin{bmatrix}0.63\\0.33\\0.04\end{bmatrix}$$

B

Q9

$$\begin{bmatrix}0.95&0.015&0.005\\0.04&0.98&0.075\\0.01&0.005&0.92\end{bmatrix}^n\begin{bmatrix}0.58\\0.37\\0.05\end{bmatrix}\to\begin{bmatrix}0.21973\\0.70852\\0.07175\end{bmatrix}\text{ for large } n.$$

B

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

Module 6: Matrices

Q1 C

Q2 $\left(\begin{bmatrix}3\\2\\1\end{bmatrix}-2\begin{bmatrix}-1\\2\\1\end{bmatrix}\right)\begin{bmatrix}-1&0&1\end{bmatrix}=\begin{bmatrix}5\\-2\\-1\end{bmatrix}\begin{bmatrix}-1&0&1\end{bmatrix}$

$$=\begin{bmatrix}-5&0&5\\2&0&-2\\1&0&-1\end{bmatrix}$$

C

Q3 D

Q4 D

Q5

$$\begin{bmatrix}1&-2&0\\0&3&-4\\-6&0&5\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}3\\5\\7\end{bmatrix}$$

$$\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}1&-2&0\\0&3&-4\\-6&0&5\end{bmatrix}^{-1}\begin{bmatrix}3\\5\\7\end{bmatrix}=-\frac{1}{99}\begin{bmatrix}45&30&24\\72&15&12\\54&36&9\end{bmatrix}\begin{bmatrix}3\\5\\7\end{bmatrix}$$

A

Q6 $\begin{bmatrix}a\\b\\c\\d\end{bmatrix}=\begin{bmatrix}2&1&-1&-1\\1&2&-1&-1\\1&1&-2&-1\\1&1&-1&-2\end{bmatrix}^{-1}\begin{bmatrix}4\\3\\2\\1\end{bmatrix}=\begin{bmatrix}2\\1\\0\\1\end{bmatrix}$

$a-b+c-d=2-1+0-1=0$ E

Q7 D

