2011 Further Mathematics Trial Exam 1 Solutions

SECTION A Core: Data analysis

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

SECTION B

Module 1: Number patterns and applications

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

SECTION A Core: Data analysis

Q1 37 dots in total D

Q2 Non-symmetric with the 'tail' of the distribution tends to the left C

Q3 The 19th dot is above 8. B

Q4 $IQR = 74 - 52 = 22$ D

Q5 $M_{all} = 67.5$, $M_{girl} = 66$, $M_{boy} = 72$ C

Q6 E

Q7 $\mu = a$, $b = a + 1\sigma$, $c = a + 2\sigma$

$a - 2\sigma < d < a - 1\sigma$, $\therefore -2 < z < -1$ E

Q8 $\frac{3}{4} \times 1952 = 1464$ C

Q9 The number of households below Q_L in 2011 equals the number of households below the median in 2005

$= 1952 \div 2 = 976$

Total number of households in $2011 = 976 \times 4 = 3904$, an increase of $3904 - 1952 = 1952$, i.e. 100% increase B

Q10 By CAS/graphics calc, $r = 0.8418$ B

Q11 B

Q12 $S.index = \frac{1}{3}\left(\frac{15}{26.25} + \frac{19}{25.58} + \frac{18}{25.83}\right) = 0.67$ B

Q13 $\frac{19}{x} = \frac{23}{28.8}$, $x = 23.8°C$ C

SECTION B

Module 1: Number patterns and applications

Q1 $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2 = 91$ B

Q2 The next two terms are $8 + 13 = 21$ and $13 + 21 = 34$

$Sum = 2 + 3 + 5 + 8 + 13 + 21 + 34 = 86$ B

Q3 $4 = 2 + 2$, $5 = 3 + 2$, $7 = 5 + 2$, $9 = 7 + 2$, $13 = 11 + 2$, $15 = 13 + 2$

2, 3, 5, 7, 11, 13 are the first six prime numbers

The next 3 terms of the sequence are the next 3 prime numbers plus 2, i.e. $17 + 2 = 19$, $19 + 2 = 21$, $23 + 2 = 25$ B

Q4 Weekly distances form an arithmetic sequence:

$80 + 51d = 250$, $d = \frac{10}{3}$ C

Q5 Weekly distances form a geometric sequence:

$25r^{51} = 250$, $r = 1.0462$, % increase $= 4.62$ E

Q6 C

Q7 $S_n = \frac{n}{2}(a + \ell) = \frac{n}{2}(1 + n)$ D

Q8 The clock advances 0.5 h in the first hour, 0.25 h in the second hour, 0.125 h in the third hour, ……

$S_\infty = \frac{a}{1 - r} = \frac{0.5}{1 - 0.5} = 1$ A

Q9 n is natural number, i.e. $n \geq 1$ C

Module 5: Networks and decision mathematics

Q1 If the degree of each vertex is odd, the number of vertices must be even. C

Q2 Each of A, B and D has exactly 2 odd vertices, and E has all even vertices. .: each has an Euler path. C has 4 odd vertices and does not have an Euler path. C

Q3 D

Q4 The minimum number of edges

$= 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 45$ E

Q5 A graph with 4 or less vertices is definitely planar. A

Q6 $15 + 28 + 7 + 5 + 5 + 8 + 9 + 9 + 8 = 94$ A

Q7 E

Q8 The path *B-E-G-I-J* gives the longest time (60 hours) to complete the task. D

Q9 D

Module 6: Matrices

Q1 A

Q2 E

Q3 E

Q4 Change the system of equations to

$$\begin{aligned} 0w+0x-1y+1z&=-2\\ 1w+1x-2y+0z&=3\\ -1w+0x+1y-1z&=0\\ -1w+1x+0y+2z&=-1 \end{aligned}$$

C

Q5

$$\begin{bmatrix} w\\ x\\ y\\ z \end{bmatrix}=\begin{bmatrix} 0 & 0 & -1 & 1\\ 1 & 1 & -2 & 0\\ -1 & 0 & 1 & -1\\ -1 & 1 & 0 & 2 \end{bmatrix}^{-1}\begin{bmatrix} -2\\ 3\\ 0\\ -1 \end{bmatrix}=\begin{bmatrix} 2\\ 3\\ 1\\ -1 \end{bmatrix}$$

E

Q6 $n=5000-(1440+992+768)=1800$ B

Q7 $13\%\times1440+9\%\times992+47\%\times768+7\%\times1800=763$ E

Q8 B

Q9

$$\begin{bmatrix} 0.48 & 0.32 & 0.06 & 0.18\\ 0.24 & 0.55 & 0.33 & 0.09\\ 0.13 & 0.09 & 0.47 & 0.07\\ 0.15 & 0.04 & 0.14 & 0.66 \end{bmatrix}^{-1}\begin{bmatrix} 1440\\ 992\\ 768\\ 1800 \end{bmatrix}=\begin{bmatrix} 2031.35\\ 133.09\\ 733.64\\ 2101.92 \end{bmatrix}$$

$5000-2102=2898$ C

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

