

**SECTION A Core: Data analysis**

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

**SECTION B**

**Module 1: Number patterns**

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

**Module 2: Geometry and trigonometry**

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

**Module 3: Graphs and relations**

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

**Module 4: Business-related mathematics**

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

**Module 5: Networks and decision mathematics**

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

**Module 6: Matrices**

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

**SECTION A Core: Data analysis**

- Q1 The 14<sup>th</sup> entry, 3.1, is the median. **B**
- Q2 25 and 37 are both  $1\sigma$  from  $\mu = 31$   
68% of 2850 = 1938 **D**
- Q3 Univariate data **C**
- Q4 The categorical variables are sex, type of car and postcode. **D**
- Q5 **B**
- Q6 Waiting time is an outlier if it is greater than  $Q_U + 1.5 \times IQR = 50 + 1.5 \times 20 = 80$  minutes **A**
- Q7 **C**
- Q8 **E**
- Q9 Slope =  $\frac{6.7 - 10.7}{1700 - 900} = -0.005$  **B**
- Q10  $12 - (\text{sum of the given values}) = 1.29$  **E**
- Q11  $\frac{\$213956}{0.89} = \$240400$  **E**
- Q12 Deseasonalised =  $\frac{\text{actual}}{1.25} = 80\%$  of actual  
∴ the actual heater sales should be reduced by 20%. **A**
- Q13 The left and right median points are (3,8) and (14,8) respectively, ∴ slope = 0 **C**

**SECTION B**

**Module 1: Number patterns**

- Q1 1.0, 1.5, 2.0, 2.5, ..... **A**
- Q2 **C**
- Q3  $100\,000 \times 1.04^4 \approx 116\,986$  **D**
- Q4 **E**
- Q5  $n = 7, d = 15, S_n = 1155, \therefore \frac{7}{2}(2a + (7-1)15) = 1155$   
∴  $a = 120$  **B**
- Q6  $t_1 = 2, r = 0.5, t_{n+1} = 0.5t_n$  **E**
- Q7 The sequence:  $p, q, p + q, \dots$   
 $t_3 + t_4 = t_5, \therefore t_5 - t_4 = t_3 = p + q$  **C**
- Q8  $r$  is a negative value, ∴ the terms alternate between positive and negative.  
 $|r|$  is greater than 1, ∴  $|t_n|$  increases with  $n$ .  
It is a geometric sequence, its graph is non-linear. **B**
- Q9 40% of  $D_{n+1} = 0.40D_{n+1} = 0.40(0.60D_n + 200)$   
 $= 0.24D_n + 80$  which is not a constant **D**

**Module 2: Geometry and trigonometry**

- Q1  $\cos \theta = \frac{3.25}{4.50}, \theta \approx 44^\circ$  **B**
- Q2 Area =  $10^2 - \pi 3^2 \approx 72$  square metres **C**
- Q3  $\angle ABC = 110^\circ - 35^\circ = 75^\circ$  **D**
- Q4  $\tan 23^\circ = \frac{300 - 150}{x}, x = \frac{150}{\tan 23^\circ} \approx 353$  m **C**
- Q5 Length =  $\sqrt{8^2 + 16^2 + (22 - 10)^2} \approx 21.54$  m **D**
- Q6  $2250^2 = 1900^2 + 2050^2 - 2(1900)(2050)\cos \angle CAB$   
∴  $\angle CAB \approx 69^\circ$ , the bearing of C from A =  $140^\circ + 69^\circ = 209^\circ$  **E**
- Q7  $s = \frac{1900 + 2050 + 2250}{2} = 3100$   
Area =  $\sqrt{3100(3100 - 1900)(3100 - 2050)(3100 - 2250)}$   
 $= \sqrt{3100 \times 1200 \times 1050 \times 850}$  square metres **A**
- Q8  $DE = \sqrt{12^2 - 10^2} = \sqrt{44}, \frac{AC}{40.4} = \frac{\sqrt{44}}{10}, AC \approx 26.8$  m **B**
- Q9 Consider only the top and middle sections.  
Let  $A$  be the surface area of the two sections.  
 $A : 180 = 15^2 : 9^2, \therefore A = 500$   
∴ the surface area of the shaded middle section  
 $= 500 - 180 = 320$  cm<sup>2</sup> **D**

### Module 3: Graphs and relations

- Q1 The length of time between 1 and 5 is 4 hours. **B**
- Q2 **E**
- Q3  $20 = \frac{k}{2}, k = 40$  **D**
- Q4  $\frac{y-1}{x-(-1)} = \frac{5-1}{3-(-1)} = 1, \therefore y = x + 2$  **B**
- Q5 **D**
- Q6  $a + 2b = 55$  and  $a + 4b = 94, \therefore a = 16.00$  and  $b = 19.50$   
The cost for 5 hours =  $16.00 + 19.50 \times 5 = 113.50$  dollars **D**
- Q7 **B**
- Q8  $x + y = 8$  and  $3x + 5y = 30$ , the point of intersection is  $(5, 3)$ .  
y-intercept of line  $3x + 5y = 30$  is  $(0, 6)$ , and x-intercept of line  $x + y = 8$  is  $(8, 0)$ . **B**
- Q9  $y \geq 2x, x + y \geq 40, x \geq 10$  and  $y \leq 30$  **C**

### Module 4: Business-related mathematics

- Q1  $1500 \left(1 + \frac{3.5}{100}\right) = 1552.50$  **D**
- Q2  $\frac{120}{15000} \times 100\% = 0.80\%$  **C**
- Q3  $15000 \times \left(1 + \frac{4.60}{100 \times 365}\right)^{150} \approx 15286$  **C**
- Q4  $(86.00 \times 4) \times \left(1 + \frac{10}{100}\right) = 378.40$  **E**
- Q5 By tvm solver: 695.07 **C**
- Q6 Flat rate =  $\frac{180 \times 6 - 1000}{1000 \times 0.5} \times 100\% = 16\%$   
Effective rate =  $\frac{2 \times 6}{6 + 1} \times 16\% = 27.4\%$  **D**
- Q7 Depreciation per year =  $\frac{18000 - 5000}{4}$   
Value after 1 year =  $18000 - \left(\frac{18000 - 5000}{4}\right)$  **B**
- Q8 End of first quarter:  $6000 \times \left(1 + \frac{4.25}{100 \times 4}\right) + 500 = 6563.75$   
End of second quarter:  $6563.75 \times \left(1 + \frac{4.25}{100 \times 4}\right) + 500 = 7133.49$   
End of third quarter:  $7133.49 \times \left(1 + \frac{4.25}{100 \times 4}\right) + 500 \approx 7709$  **D**
- Q9 By tvm solver:  $N = 48, FV = -3.57$   
The final payment (48<sup>th</sup> payment) =  $802.00 + 3.57 = 805.57$  **E**

### Module 5: Networks and decision mathematics

- Q1 **D**
- Q2 **D**
- Q3  $3 + 2 + 3 + 4 + 2 = 14$  **C**
- Q4 One-step dominance matrix  $X$  Two-step dominance matrix  $X^2$
- |   |   |   |   |   |   |
|---|---|---|---|---|---|
|   | A | B | C | D | E |
| A | 0 | 1 | 1 | 0 | 1 |
| B | 0 | 0 | 0 | 1 | 0 |
| C | 0 | 1 | 0 | 1 | 1 |
| D | 1 | 0 | 0 | 0 | 1 |
| E | 0 | 1 | 0 | 0 | 0 |
- |   |   |   |   |   |   |
|---|---|---|---|---|---|
|   | A | B | C | D | E |
| A | 0 | 2 | 0 | 2 | 1 |
| B | 1 | 0 | 0 | 0 | 1 |
| C | 1 | 1 | 0 | 1 | 1 |
| D | 0 | 2 | 1 | 0 | 1 |
| E | 0 | 0 | 0 | 1 | 0 |
- Dominance score = sum of one - step and two - step dominances
- |    |   |   |   |    |
|----|---|---|---|----|
| A  | B | C | D | E  |
| [3 | 8 | 2 | 6 | 7] |
- $\therefore$  The ranking from highest to lowest is **BEDAC** **A**

- Q5 **A**
- Q6 Only the star has an Eulerian circuit, i.e. a path starting and finishing at the same vertex using all available edges. **B**
- Q7 **E**
- Q8 **E**
- Q9 Cut D is a minimum cut separating the two car parks from the exit. **D**

### Module 6: Matrices

- Q1 **A**
- Q2 **B**
- Q3 As  $n \rightarrow \infty,$
- |   |      |      |      |   |
|---|------|------|------|---|
|   | S    | J    | N    |   |
| S | 0.75 | 0.10 | 0.10 | $\begin{bmatrix} 200 \\ 200 \\ 200 \end{bmatrix} \rightarrow \begin{bmatrix} 171 \\ 204 \\ 225 \end{bmatrix}$ |
| J | 0.10 | 0.75 | 0.15 |   |
| N | 0.15 | 0.15 | 0.75 |   |
- Q4 **C**
- Q5 **C**
- Q6 **E**
- Q7  $S_1 = T^{-1}S_2 = \begin{bmatrix} 400 \\ 0 \\ 200 \end{bmatrix}$  **D**
- Q8
- |   |   |   |   |   |   |   |   |                          |
|---|---|---|---|---|---|---|---|--------------------------|
| $\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ | $\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$ | $\begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$ | $\begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$ | $\begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$ | $\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ | $\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ | $\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ | $\therefore$ <b>EDBA</b> |
|---|---|---|---|---|---|---|---|--------------------------|
- Q9 **C**

Please inform [mathline@itute.com](mailto:mathline@itute.com) re conceptual, mathematical and/or typing errors