

**SECTION A Core: Data analysis**

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

**SECTION B**

**Module 1: Number patterns and applications**

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

**Module 5: Networks and decision mathematics**

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

**Module 6: Matrices**

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

**SECTION A Core: Data analysis**

Q1 There are 20 students with weights greater than 63, the mode.  $\frac{20}{25} \times 100\% = 80\%$  C

Q2 To be an outlier it must be  $\leq Q_1 - 1.5 \times IQR$  or  $\geq Q_3 + 1.5 \times IQR$ .  $Q_1 = 65.5$ ,  $Q_3 = 77.5$ ,  $IQR = 77.5 - 65.5 = 12$   $\therefore 90$  is not an outlier. B

Q3  $2.066 - 1.972 = 0.094$ ,  $\frac{0.094}{1.972} \times 100\% \approx 4.8\%$ . B

Q4 2007:  $55\% \times 1.972 = 1.0846$   
2008:  $53\% \times 2.066 = 1.09498$   
 $1.09498 - 1.0846 = 0.01038$ ,  $\frac{0.01038}{1.0846} \times 100\% \approx 1\%$ . D

Q5 From 1990 to 2007 the average % growth in annual demand for crude oil for non-OECD and OECD countries are 32% and 20% respectively. C

Q6 E

Q7 C

Q8  $a = 30.9$ ,  $b = -1.52$ ,  $r = -0.567$ ,  $\bar{x} = 4.56$ ,  $s_x = 2.61$ .

Use  $a = \bar{y} - b\bar{x}$ ,  $b = r \frac{s_y}{s_x}$  to find  $\bar{y} = 24.0$ ,  $s_y = 7.00$ . A

Q9  $(x_L, y_L)$  is (2,5) and  $(x_U, y_U)$  is (7,13).

Slope =  $\frac{13-5}{7-2} = \frac{8}{5} = 1.6$ . A

Q10 The extra point (6,12) belongs to the middle group of points and does not affect the calculation of the slope. A

Q11 E

Q12

| Year | March quarter | June quarter | Sept. quarter | Dec. quarter | Average |
|------|---------------|--------------|---------------|--------------|---------|
| 2005 | 68            | 72           | 79            | 90           | 77.25   |
| 2006 | 96            | 104          | 103           | 108          | 102.75  |
| 2007 | 100           | 97           | 99            | 93           | 97.25   |

Seasonal index for the June quarter over the three years  
=  $\left( \frac{72}{77.25} + \frac{104}{102.75} + \frac{97}{97.25} \right) \div 3 = 0.981$ . B

Q13 Seasonally adjusted number of computers sold in the December quarter 2006 =  $10800 \div 1.0575 = 10213$ . A

**SECTION B**

**Module 1: Number patterns and applications**

Q1 The next three terms are  $\frac{6^2}{2}, \frac{7^2}{2}, \frac{8^2}{2}$ , i.e.  $18, \frac{49}{2}, 32$ . C

Q2  $T_4 = 2^{4-1} = 8$ ,  $T_5 = -2 + (5-1)5 = 18$ . D

Q3 Total  
=  $1 \times 2 + 2 \times 3 + 3 \times 4 + 4 \times 5 + 5 \times 6 + 6 \times 7 + 7 \times 8 = 168$ . A

Q4

| No. of lines | 1 | 2 | 3 | 4  | 5  |
|--------------|---|---|---|----|----|
| No. of parts | 2 | 4 | 7 | 11 | 16 |

The pattern:  $2 + 2 = 4$ ,  $4 + 3 = 7$ ,  $7 + 4 = 11$ ,  $11 + 5 = 16$ . C

Q5  $T_n = T_{n-1} + n$  E

Q6  $T_n = \frac{n(n+1)}{2} + 1$  C

Q7 The next two terms are  $8 + 13 = 21$  and  $13 + 21 = 34$ ,  $\therefore 34 - 21 = 13$ . C

Q8 The  $n^{\text{th}}$  term is  $t_n = 2^n$ .  $S_{22} = S_{20} + t_{21} + t_{22}$ ,  
 $\therefore S_{22} - S_{20} = t_{21} + t_{22} = 2^{21} + 2^{22} = 2^{21} + 2 \times 2^{21} = 3(2^{21})$  E

Q9  $t_{n+1} = 5t_n$ ,  $\therefore t_2 = 5t_1 = \frac{1}{2}$ ,  $\therefore t_1 = \frac{1}{10} = 0.1$ .  
 $\therefore t_2 = 0.1(5) = \frac{0.1}{5}(5^2) = 0.02(5^2)$ ,  $\therefore t_n = 0.02(5^n)$ . A

### Module 5: Networks and decision mathematics

Q1 No. of vertices = 7, no. of edges = 8, sum of degrees of vertices = 16.

D

Q2 Euler's formula:  $v - e + f = 2$ .  $\therefore e - v = f - 2 = 6$  C

Q3 An Euler path is a path that includes every edge just once. C

Q4 A Hamiltonian path is a path that passes through each vertex just once, and the starting vertex is different from the finishing vertex.

E

Q5 A spanning tree is a subgraph and a tree containing all the vertices of the graph. C is not a subgraph. C

Q6  $53 + 8 + 17 + 16 + 7 + 22 = 123$  D

Q7 Maximum flow = minimum cut = 3 B

Q8 A critical path has the longest time to complete a project. D

Q9 E

### Module 6: Matrices

Q1 Subtraction of matrices having different orders is not defined. E

Q2  $(4 \times 1) \times (1 \times 4)$  gives  $(4 \times 4)$  E

Q3  $X \begin{bmatrix} -2 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} = \begin{bmatrix} 4 & -2 & 0 \\ -2 & 2 & -1 \end{bmatrix}$   
 $X$  must be a  $2 \times 2$  matrix for the product to be defined. D

Q4  $\begin{bmatrix} 3 & 2 & 3 \\ 5 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 162 \\ 158 \\ 184 \end{bmatrix}$   
 $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 & 2 & 3 \\ 5 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix}^{-1} \begin{bmatrix} 162 \\ 158 \\ 184 \end{bmatrix}$  C

Q5  $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 & 2 & 3 \\ 5 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix}^{-1} \begin{bmatrix} 162 \\ 158 \\ 184 \end{bmatrix} = \begin{bmatrix} 18 \\ 24 \\ 20 \end{bmatrix}$   $\therefore \begin{bmatrix} y \\ z \end{bmatrix} = \begin{bmatrix} 24 \\ 20 \end{bmatrix}$  A

Q6 The matrices in C, D and E are singular and do not have an inverse.

$\begin{bmatrix} p & q \\ r & s \\ t & u \end{bmatrix} \begin{bmatrix} 1 & 3 & 0 \\ 1 & 4 & 0 \end{bmatrix} = \begin{bmatrix} \quad & \quad & \quad \\ \quad & \quad & \quad \\ 0 & \quad & \quad \end{bmatrix} \neq \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$   
 $\therefore \begin{bmatrix} 1 & 3 & 0 \\ 1 & 4 & 0 \end{bmatrix}$  has no left multiplicative inverse. A

Q7 72% of Q's customers return to Q,  $\therefore$  28% go to the other two outlets. A

Q8  $\begin{bmatrix} 0.75 & 0.12 & 0.10 \\ 0.13 & 0.72 & 0.08 \\ 0.12 & 0.16 & 0.82 \end{bmatrix}^5 \begin{bmatrix} 2500 \\ 3100 \\ 1900 \end{bmatrix} \approx \begin{bmatrix} 2304 \\ 2114 \\ 3082 \end{bmatrix}$  D

Q9  $\left( \begin{bmatrix} 0.75 & 0.12 & 0.10 \\ 0.13 & 0.72 & 0.08 \\ 0.12 & 0.16 & 0.82 \end{bmatrix}^{-1} \right)^2 \begin{bmatrix} 2500 \\ 3100 \\ 1900 \end{bmatrix} \approx \begin{bmatrix} 2670 \\ 4643 \\ 187 \end{bmatrix}$  A

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