# 2023 VCAA General Mathematics Exam 2 Solutions

**Data analysis**

Q1a  Two, they are *ID* and size.
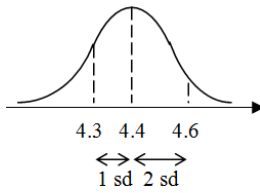
Q1bi  mean $= 11.42$

Q1bii  median $= 14.1$

Q1ci  volume

Q1cii  $0.953 \times 10 = 9.53$

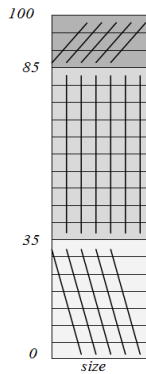Q1d  $Volume = 0.002857 + 2.571 \times image\ size$

Q1e  mean $= 4.4$  standard deviation $= 0.1$



4.3  4.4  4.6

1 sd  2 sd

Q2ai

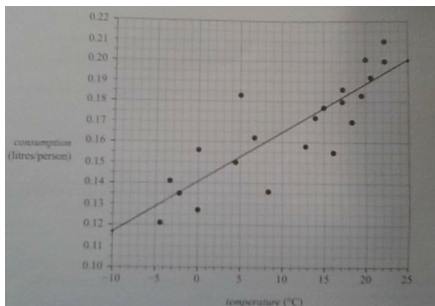| Size | Frequency | % |
|------|-----------|-----|
| small | 7 | 35 |
| medium | 10 | 50 |
| large | 3 | 15 |
| Total | 20 | 100 |

Q2aii



Q2bi  $\dfrac{44 + 46}{210 + 320} \approx 0.1698 \approx 17\%$

Q2bii  Yes, the information in Table 3 supports the farmer's believe.

Farm A: $\dfrac{44}{210} \approx 21\%$ large oysters

Farm B: $\dfrac{46}{320} \approx 14\%$ large oysters

Q3a  $(-10, 0.1164)$, $(25, 0.2004)$



Q3b  $r = \sqrt{0.7212} \approx 0.849$

Q3c  Strong, positive, linear

Q3d  Intercept: $(0, 0.1404)$

At temperature  0°C  the ice cream consumption is 0.1404 L/person.

Q3e  $consumption = 0.1404 + 0.0024 \times {}^{-}6 = 0.126$  L/person

Q3f  Extrapolation

Q4a  The occurrence of peak followed by trough  is repeated annually.

Q4b  Read from graph, actual consumption for month $4 = 0.18$

Deseasonalised value $= \dfrac{0.18}{1.05} \approx 0.17$

Q4c  Average for the year $= \dfrac{sum\ of\ monthly\ averages}{12} \approx 0.167$

S.I. for July $\approx \dfrac{July\ average}{0.167} \approx \dfrac{0.183}{0.167} \approx 1.10$

**Recursion and financial modelling**

Q5a  24

Q5b  $A_0 = 30000$, $A_1 = 1.016 \times 30000 - 1515.18 = 28964.82$
$A_1 = 1.016 \times 28964.82 - 1515.18 = 27913.08$

Q5c  Final payment $\approx 1515.18 - 0.14 = 1515.04$  (0.14 by TVM Solver)

Q6a  I% $= 0.42\% \times 12 = 5.04\%$

Q6b

| 3 | 3973.00 | 2507.77 | 1465.23 | 595622.67 |
|---|---------|---------|---------|-----------|

Q6c  $V_0 = 600000$, $V_{n+1} = 1.0042 \times V_n - 3973.00$

Q6d  Perpetuity

Q7a  $(1.0015 - 1) \times 52 = 0.078 = 7.8\%$

Q7bi  Weekly interest rate $= 0.0015$, $d = 60000 \times 0.0015 = 90$

Q7bii  By TVM Solver  \$278.86

Q7c  By TVM Solver  \$350.01

Q7d  Without any repayment ($d = 0$),
$V_0 = 60000$, $V_1 = 60000 \times 1.0015$, $V_2 = 60000 \times 1.0015^2$, … is a geometric sequence.

**Matrices**

Q8a  $n_{31}$

Q8b  $\begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$

Q8c  $\begin{bmatrix} 204 & 0 & 0 \\ 0 & 162 & 0 \\ 0 & 0 & 176 \end{bmatrix}$

Q9a  $\begin{bmatrix} \frac{1}{20} \end{bmatrix} \times R = \begin{bmatrix} 48000 & 49525 & 47005 & 46040 & 45065 \end{bmatrix}$

Q9b  $t = 1.25$

Q9c  *IHEGF*

**Q9d**

$$\begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

**Q10a** *CSMD*

**Q10bi**

$$\begin{bmatrix} 1 & 2 & 1 & 2 & 2 \\ 0 & 3 & 1 & 2 & 2 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 2 & 1 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

**Q10bii** The only way performers $P$ and sales staff $S$ can communicate with directors $D$ is through managers $M$.

**Q11a**

$$T = \begin{bmatrix} 0.95 & 0 \\ 0.05 & 1 \end{bmatrix}$$

**Q11b**

$$B = \begin{bmatrix} 9 \\ 0 \end{bmatrix}$$

**Networks and decision mathematics**

**Q12a** $2 + 3 + 4 + 3 + 2 = 14$

**Q12bi** $5 + 4 = 7 + 2$

**Q12bii** planar

**Q12c**

| State | State number |
|-------|-------------|
| *B* | 3 |
| *C* | 2 |
| *D* | 4 |
| *E* | 1 |

**Q13a** $1.5 + 1.2 + 3.2 = 5.9$ km

**Q13b** $G\ H\ K\ I\ J\ M\ O\ L\ N\ G$

**Q13c** vertex $N$ and vertex $L$; vertex $M$ and vertex $J$

**Q14a** $C$ and $G$

**Q14b** $4 + 5 + 7 = 16$

**Q14c** Five. Activities $A$, $C$, $I$, $K$ and $L$ are on the critical path.

**Q14d** Two

**Q14e**

| Activity | Reduction in completion time |
|----------|------------------------------|
| *A* | 2 |
| *B* | 2 |
| *F* | 0 |
| *H* | 2 |
| *I* | 2 |
| *K* | 1 |

Increase in cost
$= 2 \times 1500 + 2 \times 2000 + 2 * 1000 + 2 \times 1500 + 1 \times 3000 = 15000$

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