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Student Name……………………………………

GENERAL MATHEMATICS UNITS 3 & 4

TRIAL EXAMINATION 1

2023

Reading Time: 15 minutes
Writing time: 1 hour 30 minutes

Instructions to students

This exam consists of 40 questions.
All 40 questions should be answered.
There is a total of 40 marks available for this exam.
Students may bring one bound reference into the exam.
Students may bring into the exam one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory does not need to be cleared. For approved computer-based CAS, full functionality may be used.
Unless otherwise stated, the diagrams in this exam are not drawn to scale.
Formula sheets can be found on pages 24 and 25 of this exam.
An answer sheet appears on page 26 of this exam.

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Data analysis

Use the following information to answer Questions 1 and 2.

The *time of entry* (12.00am – 5.59am, 6.00am – 7.59pm, 8.00pm – 11.59pm) and the *type of entry pass* (staff, visitor, security) used to gain entry to an office building, were recorded for all entries to the building last Thursday. The results are displayed in the table below.

Time of entry	**Type of entry pass**		
	Staff	**Visitor**	**Security**
12.00am – 5.59am	2	0	5
6.00am – 7.59pm	243	75	9
8.00pm – 11.59pm	67	14	6
Total	312	89	20

Question 1

Of the entries to the building last Thursday that used a staff entry pass, the percentage that occurred between 6.00am and 7.59pm, was closest to

A. 1%
B. 23%
C. 74%
D. 78%
E. 84%

Question 2

The variables *time of entry* (12.00am – 5.59am, 6.00am – 7.59pm, 8.00pm – 11.59pm) and *type of entry pass* (staff, visitor, security) are

A. both numerical variables.
B. both nominal variables.
C. both ordinal variables.
D. a nominal variable and an ordinal variable respectively.
E. an ordinal variable and a nominal variable respectively.

Question 3

The stem plot below shows the distribution of the average *cost*, in dollars, of main courses at 18 city restaurants.

key: $2|4 = \$24$ $\quad n = 18$

2	4				
2	5	6	7	8	
3	0	1	4		
3	6	7	7	9	
4	1	3	3	4	4
4	8				

The interquartile range (IQR) for this distribution is

A. 15
B. 24
C. 28
D. 35
E. 42

Question 4

The *length*, in centimetres, of a sample of bush rats can be displayed graphically.
The mean length of the sample was calculated using only the graphical display.
The graphical display could be a

A. box plot
B. histogram
C. least squares line
D. dot plot
E. time series plot

Question 5

The *iron level*, in micrograms per deciliter (μg/dL), for 650 people was recorded.
The table below shows the mean and five-number summary which was calculated using the data values obtained.

	Iron level (μg/dL)
Mean	105
Minimum value	25
First quartile (Q_1)	95
Median	130
Third quartile (Q_3)	140
Maximum value	155

The shape of the distribution of these data values is best described as

A. negatively skewed.
B. negatively skewed with one or more outliers.
C. positively skewed.
D. positively skewed with one or more outliers.
E. approximately symmetric.

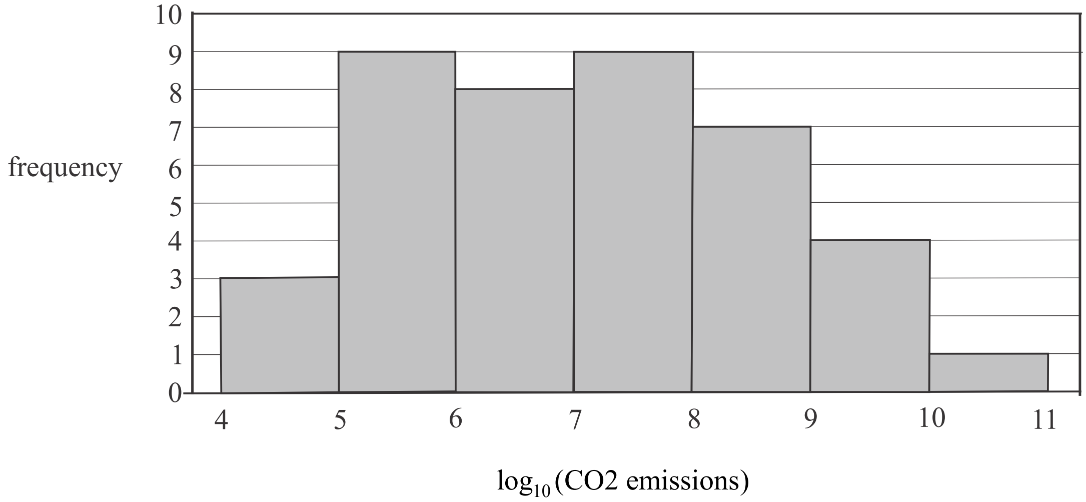
Question 6

The mass, in grams, of boxes of a breakfast cereal, are normally distributed with a mean of 760 g and a standard deviation of 5 g.
A warehouse stores 5600 of these boxes of cereal.
Using the 68 – 95 – 99.7% rule, the number of these boxes of cereal in the warehouse that have a mass between 750 g and 765 g is

A. 3583
B. 4564
C. 5320
D. 5432
E. 5592

Question 7

The histogram below displays the distribution of CO2 emissions, in tonnes, plotted on a logarithmic (base 10) scale, for a sample of 41 countries in 2016.

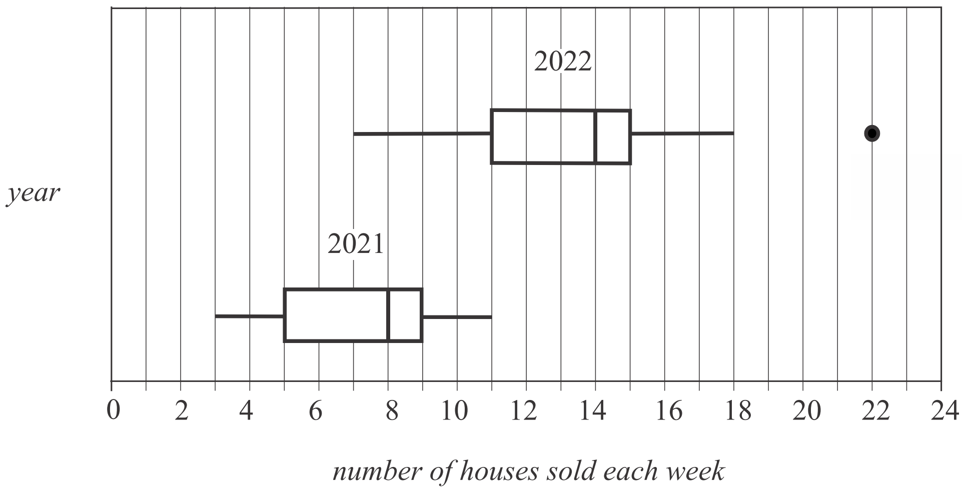


The percentage of these countries which emitted more than one billion (ie 1000 000 000) tonnes of CO2 in 2016 is closest to

A. 2%
B. 12%
C. 29%
D. 51%
E. 71%

Use the following information to answer Questions 8 and 9.

The boxplots below show the distribution of the number of houses sold each week in a regional town in 2021 and 2022.



Question 8

For the distribution of the number of houses sold each week in 2022, the upper fence is

A. 12
B. 15
C. 18
D. 20
E. 21

Question 9

Using the boxplots shown above, it can be said that

A. the range of the number of houses sold each week in 2022 is 11.
B. for 75% of the weeks in 2021, the number of houses sold is less than eight.
C. the number of houses sold each week in 2021 is, on average, higher than the number of houses sold each week in 2022.
D. for more than 50% of the weeks in 2022, the number of houses sold is greater than the number of houses sold in any of the weeks in 2021.
E. the number of houses sold each week in 2021 is more variable than in 2022.

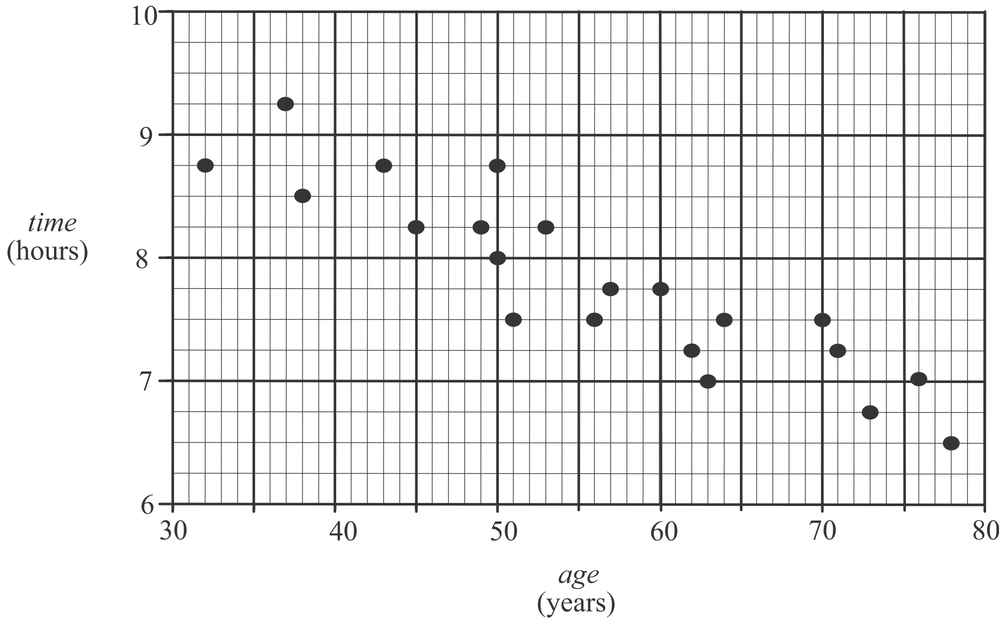
Question 10

The time, in seconds, taken by teenage boys in a rural town to run 200 metres, is normally distributed.
Two teenage boys, Tom and Marco, live in the town.
Tom's time is 37 seconds and he has a standardised time of $z = 1$.
Marco's time is 28 seconds and he has a standardised time of $z = -2$.
The mean and standard deviation, in seconds, of the time taken to run 200 metres for the teenage boy population in this rural town, are closest to

A. mean = 34 standard deviation = 2.25
B. mean = 34 standard deviation = 3
C. mean = 34.5 standard deviation = 2.25
D. mean = 34.5 standard deviation = 3
E. mean = 35 standard deviation = 2.5

Question 11

The scatterplot below shows the median nightly sleeping *time*, in hours, of 21 people, plotted against their *age*, in years.



The coefficient of determination was calculated to be 0.81912.
The value of the correlation coefficient, rounded to three decimal places, is

A. – 0.905
B. – 0.819
C. 0.693
D. 0.819
E. 0.905

Question 12

In a study of the association between the *height* and *tibia bone length,* both in centimetres, of male adults, the following equation for the least squares line was obtained.

$$height = 122.6 + 1.25 \times tibia\ bone\ length$$

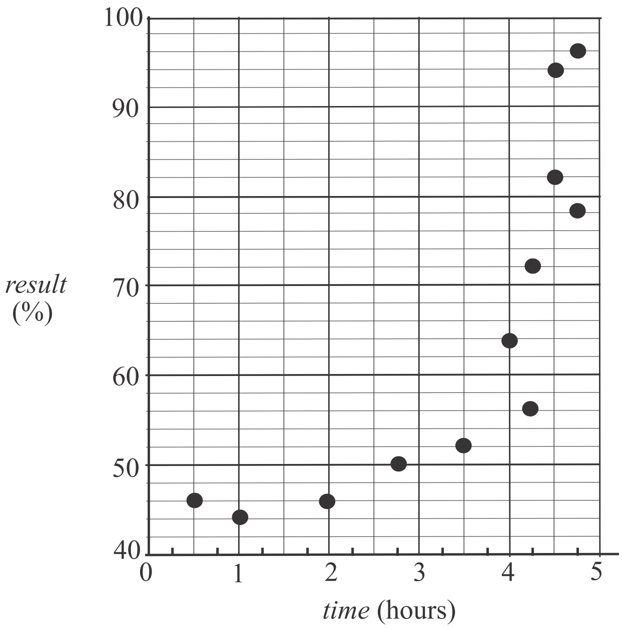
The slope of the least squares line predicts that, on average, for every increase of

A. 1 cm in *height*, there will be an increase of 1.25 cm in *tibia bone length*.
B. 1 cm in *tibia bone length*, there will be an increase of 1 cm in *height*.
C. 1 cm in *tibia bone length*, there will be an increase of 1.25 cm in *height*.
D. 1.25 cm in *height*, there will be an increase of 1 cm in *tibia bone length*.
E. 1.25 cm in *tibia bone length*, there will be an increase of 122.6 cm in *height*.

Question 13

The table below shows the *result*, expressed as a percentage, of an assignment and the *time*, in hours, that 12 students estimated they took to complete it.
A scatterplot displaying the data is also shown.

result (%)	*time* (hours)
46	0.5
44	1
46	2
50	2.75
52	3.5
56	4.25
64	4
72	4.25
94	4.5
82	4.5
96	4.75
78	4.75



A $\log_{10}$ transformation to the variable *result* is to be applied in an attempt to linearise the scatterplot.
With $\log_{10}(result)$ as the response variable, the equation of the least squares line fitted to the transformed data is closest to

A. $\log_{10}(result) = -14.76 + 10.11 \times time$
B. $\log_{10}(result) = -0.6914 + 0.0629 \times time$
C. $\log_{10}(result) = 1.372 + 0.0629 \times time$
D. $\log_{10}(result) = 1.558 + 0.0703 \times time$
E. $\log_{10}(result) = 30.50 + 10.16 \times time$

Use the following information to answer Questions 14 and 15.

The table below shows the monthly number of stray dogs, picked up by rangers across the state in 2022 and the associated long-term seasonal indices for each month of the year except November.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of stray dogs	81	60	49	32	41	36	48	41	45	44	52	71
Seasonal index	1.42	1.26	1.07	0.69	0.78	0.61	1.29	0.75	0.87	0.92		1.21

Question 14

The four-mean smoothed number of stray dogs, with centring, picked up during April is closest to

A. 39
B. 40
C. 43
D. 45
E. 46

Question 15

The deseasonalised number of stray dogs picked up in November 2022 is closest to

A. 43
B. 46
C. 48
D. 49
E. 52

Question 16

The seasonal index for sales of ski gear in January is 0.625. To correct for seasonality, the actual sales of ski gear in January should be

A. decreased by 60%
B. decreased by 62.5%
C. increased by 37.5%
D. increased by 60%
E. increased by 62.5%

Recursion and financial modelling

Question 17

Consider the recurrence relation shown below.

$$T_0 = 1, \qquad T_{n+1} = 3T_n - 4$$

The value of T_3 can be found by evaluating

A. $3 \times -7 - 4$
B. $3 \times -1 - 4$
C. $3 \times 1 - 4$
D. $3 \times 3 - 4$
E. $3 \times 7 - 4$

Use the following information to answer Questions 18 and 19.

Stacey has taken out a reducing balance loan of $400 000.
She makes quarterly repayments and interest is calculated immediately before each repayment. Four lines of the amortisation table for Stacey's loan are shown below.

Payment number	Payment ($)	Interest ($)	Principal reduction ($)	Balance ($)
0	0.00	0.00	0.00	400 000.00
1	9281.10	8000.00	1281.10	398 718.90
2	9281.10	7974.38		397 412.18
3	9281.10	7948.24	1332.86	396 079.32

Question 18

The principal reduction associated with payment number two is

A. $1281.10
B. $1306.72
C. $1321.59
D. $1332.86
E. $1493.53

Question 19

A recurrence relation that can be used to model the balance B_n, in dollars, of this reducing balance loan after n quarters, is given by

A. $B_0 = 400\,000, \quad B_{n+1} = 0.002B_n - 9281.10$
B. $B_0 = 400\,000, \quad B_{n+1} = 0.02B_n - 9281.10$
C. $B_0 = 400\,000, \quad B_{n+1} = B_n - 9281.10$
D. $B_0 = 400\,000, \quad B_{n+1} = 1.002B_n - 9281.10$
E. $B_0 = 400\,000, \quad B_{n+1} = 1.02B_n - 9281.10$

Question 20

Karl invests in an annuity investment earning compound interest calculated monthly.
He makes equal monthly payments to this investment after one large initial payment.
The balance of the investment after n months is modelled by the recurrence relation

$$T_0 = 55\,000, \qquad T_{n+1} = 1.005T_n + 2800$$

Consider the following four statements about this investment.

- Karl's initial payment is \$55 000.
- The annual interest rate is 6%.
- Karl's monthly payment is \$2800.
- The monthly interest rate is 0.5%.

The number of these statements that are true is

A. 0
B. 1
C. 2
D. 3
E. 4

Question 21

A loan has a nominal interest rate of 6% per annum.
The effective interest rate for this loan, when rounded to two decimal places, is

A. 6.20% per annum when interest is charged daily
B. 6.19% per annum when interest is charged weekly
C. 6.17% per annum when interest is charged monthly
D. 6.13% per annum when interest is charged quarterly
E. 6.01% per annum when interest is charged yearly

Question 22

A piece of equipment is purchased for \$15 000.
The value of the equipment is depreciated using reducing balance depreciation at the rate of 6% per annum compounding quarterly.
A rule for the value of the equipment, V_n, in dollars after n years is given by

A. $V_n = 15\,000 \times 0.94^{n}$
B. $V_n = 15\,000 \times 0.94^{4n}$
C. $V_n = 15\,000 \times 1.94^{4n}$
D. $V_n = 15\,000 \times 0.985^{n}$
E. $V_n = 15\,000 \times 0.985^{4n}$

Question 23

Gayle invests in an annuity investment account that earns interest of 4.2% per annum compounding monthly.
She initially invests \$36 000 and will add equal monthly payments immediately after the interest is calculated.
Her aim is to reach a balance of \$80 000 after four years.
To achieve this, the minimum value of her monthly payments will be closest to

A. \$717.42
B. \$899.90
C. \$2349.56
D. \$2552.53
E. \$10 816.42

Question 24

Katelyn borrowed \$32 000 to buy a car. Interest on her loan is charged at 7.2% per annum compounding monthly. Katelyn will repay the loan over five years with 60 monthly repayments. The first 59 of these will be \$636.66.
In order that the loan is repaid to the nearest cent, the final payment, compared to the first 59 payments, will be

A. \$0.16 higher
B. \$3.64 higher
C. \$4.21 higher
D. \$0.16 lower
E. \$3.64 lower

Matrices

Question 25

Let matrix $N = \begin{bmatrix} 2 & 3 \\ 5 & 8 \end{bmatrix}$.

Its transpose, N^T, is

A. $\begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$

B. $\begin{bmatrix} 8 & -3 \\ -5 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 3 & 2 \\ 8 & 5 \end{bmatrix}$

D. $\begin{bmatrix} -2 & 5 \\ 3 & -8 \end{bmatrix}$

E. $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$

Question 26

Consider the following four matrix expressions.

$$\begin{bmatrix} 2 & 1 \end{bmatrix} + \begin{bmatrix} 3 \\ 4 \end{bmatrix} \qquad 3 \times \begin{bmatrix} 2 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 7 \end{bmatrix} \times \begin{bmatrix} 1 \\ 4 \end{bmatrix} \qquad \begin{bmatrix} 6 \\ 1 \end{bmatrix}^2$$

How many of these four matrix expressions are defined?

A. 0
B. 1
C. 2
D. 3
E. 4

Question 27

For matrix A, the element in row i and column j is a_{ij}.
The elements in matrix A have been created using the rule $a_{ij} = 2i - j$.
Matrix A could **not** be

A. $\begin{bmatrix} 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 1 \\ 3 \end{bmatrix}$

D. $\begin{bmatrix} 1 \\ 3 \\ 5 \end{bmatrix}$

E. $\begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$

Question 28

An aquarium studies the breeding patterns of a female population of fish.
These fish have a lifespan of four years and in the study, they are divided into four age groups of 0 – 1 years, 1 – 2 years, 2 – 3 years and 3 – 4 years.
The table below shows the *birth rate*, that is, the average proportion of female baby fish produced by each age group, and the *survival rate*, that is, the average proportion of female fish in each age group that survive to the next age group, for each of the four age groups.

	Age group (years)			
	0 – 1	**1 – 2**	**2 – 3**	**3 – 4**
Birth rate	0	0.7	1.2	0.3
Survival rate	0.8	0.9	0.6	0

The Leslie matrix, L, that models the breeding patterns of this female population of fish is given by

A. $$L = \begin{array}{c} \textit{this year} \\ \begin{bmatrix} 0 & 0.7 & 1.2 & 0.3 \\ 0 & 0 & 0 & 0 \\ 0.8 & 0.9 & 0.6 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array} \textit{next year}$$

B. $$L = \begin{array}{c} \textit{this year} \\ \begin{bmatrix} 0.8 & 0.9 & 0.6 & 0 \\ 0 & 0.7 & 0 & 0 \\ 0 & 0 & 1.2 & 0 \\ 0 & 0 & 0 & 0.3 \end{bmatrix} \end{array} \textit{next year}$$

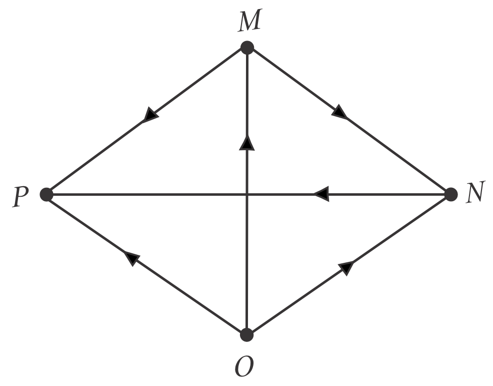
C. $$L = \begin{array}{c} \textit{this year} \\ \begin{bmatrix} 0 & 0.8 & 0.9 & 0.6 \\ 0.7 & 0 & 0 & 0 \\ 0 & 1.2 & 0 & 0 \\ 0 & 0 & 0.3 & 0 \end{bmatrix} \end{array} \textit{next year}$$

D. $$L = \begin{array}{c} \textit{this year} \\ \begin{bmatrix} 0 & 0.7 & 1.2 & 0.3 \\ 0.8 & 0 & 0 & 0 \\ 0 & 0.9 & 0 & 0 \\ 0 & 0 & 0.6 & 0 \end{bmatrix} \end{array} \textit{next year}$$

E. $$L = \begin{array}{c} \textit{this year} \\ \begin{bmatrix} 0 & 0.7 & 1.2 & 0.3 \\ 0 & 0.8 & 0 & 0 \\ 0 & 0 & 0.9 & 0 \\ 0 & 0 & 0 & 0.6 \end{bmatrix} \end{array} \textit{next year}$$

Question 29

The diagram below shows the results of a tennis competition between four players, Monica (M), Noa (N), Olivia (O) and Paolo (P).



Each player played each of the other players just once.
The winner of each match is indicated by the arrows.
For example, the arrow from M to N indicates that Monica defeated Noa.
A matrix that shows the two-step dominances in the competition can be constructed where the *winner* is the person who has two-step dominance over the *loser*.
That matrix is

A.
$$\begin{array}{cc} & \textit{loser} \\ & \begin{array}{cccc} M & N & O & P \end{array} \\ \textit{winner} \begin{array}{c} M \\ N \\ O \\ P \end{array} & \begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

B.
$$\begin{array}{cc} & \textit{loser} \\ & \begin{array}{cccc} M & N & O & P \end{array} \\ \textit{winner} \begin{array}{c} M \\ N \\ O \\ P \end{array} & \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

C.
$$\begin{array}{cc} & \textit{loser} \\ & \begin{array}{cccc} M & N & O & P \end{array} \\ \textit{winner} \begin{array}{c} M \\ N \\ O \\ P \end{array} & \begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

D.
$$\begin{array}{cc} & \textit{loser} \\ & \begin{array}{cccc} M & N & O & P \end{array} \\ \textit{winner} \begin{array}{c} M \\ N \\ O \\ P \end{array} & \begin{bmatrix} 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

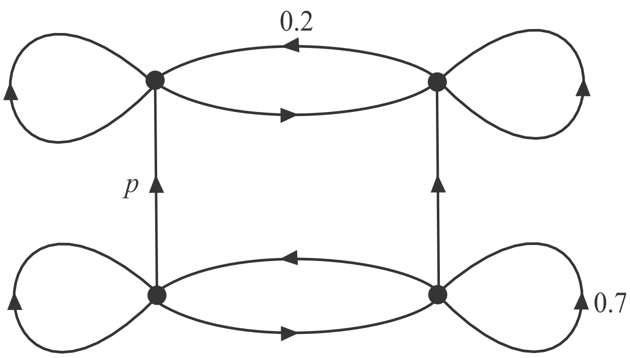
E.
$$\begin{array}{cc} & \textit{loser} \\ & \begin{array}{cccc} M & N & O & P \end{array} \\ \textit{winner} \begin{array}{c} M \\ N \\ O \\ P \end{array} & \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

Question 30

A salad bar serves four different salads: avocado (A), beetroot (B), citrus (C) and dill (D). Regular customers change their preferences for the type of salad they purchase each day according to the transition matrix Q below.

$$\begin{array}{cc} & \text{today} \\ & \begin{array}{cccc} A & B & C & D \end{array} \\ Q = & \begin{bmatrix} 0.7 & 0 & 0 & 0.1 \\ 0.1 & 0.8 & 0.1 & 0 \\ 0 & 0.2 & 0.9 & 0.1 \\ 0.2 & 0 & 0 & 0.8 \end{bmatrix} \begin{array}{c} A \\ B \\ C \\ D \end{array} \text{tomorrow} \end{array}$$

An incomplete transition diagram has been constructed below using matrix Q.



One of the transitions has a proportion labelled p.

The value of p is

A. 0.1
B. 0.2
C. 0.7
D. 0.8
E. 0.9

Question 31

The table below shows the number of players at a sporting club who received each of four different match payments for a match last weekend.

Payment ($)	50	200	350	500
Number of Players	7	12	15	3

The matrix product that displays the total number of players and the total value of payments made for the match last weekend is

A. $\begin{bmatrix} 7 \\ 12 \\ 15 \\ 3 \end{bmatrix}\begin{bmatrix} 50 & 200 & 350 & 500 \end{bmatrix}$

B. $\begin{bmatrix} 50 & 200 & 350 & 500 \\ 7 & 12 & 15 & 3 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$

C. $\begin{bmatrix} 7 & 12 & 15 & 3 \end{bmatrix}\begin{bmatrix} 50 \\ 200 \\ 350 \\ 500 \end{bmatrix}$

D. $\begin{bmatrix} 50 & 200 & 350 & 500 \end{bmatrix}\begin{bmatrix} 1 & 7 \\ 1 & 12 \\ 1 & 15 \\ 1 & 3 \end{bmatrix}$

E. $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 50 & 200 & 350 & 500 \end{bmatrix}\begin{bmatrix} 7 \\ 12 \\ 15 \\ 3 \end{bmatrix}$

Question 32

Consider the matrix product $QP = R$ where matrix Q is a row matrix with no zero elements and matrix P is a 4×4 permutation matrix.
Which one of the following equations involving various elements in matrices Q, P and R could be true?

A. $p_{24} = 3$

B. $r_{15} = 1$

C. $q_{12} = r_{14}$

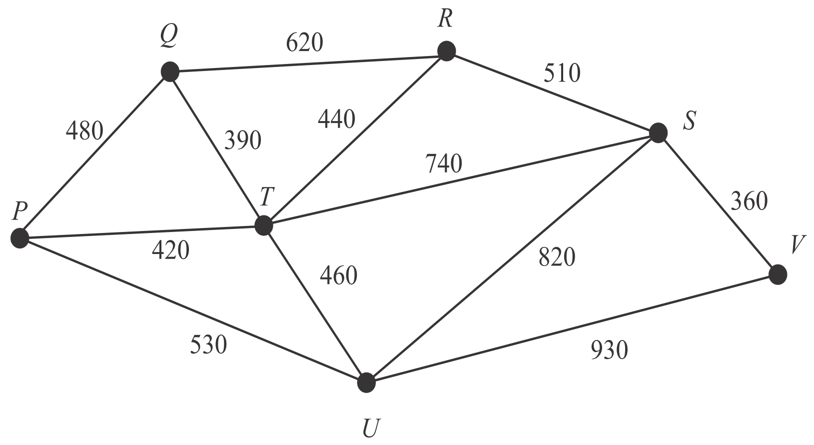
D. $q_{13} = 0$

E. $p_{12} + p_{32} = 2$

Networks and decision mathematics

Question 33

The network below shows the distance, in metres, of a series of paths in parkland.
The junctions of these paths are indicated by the vertices *P, Q, R, S, T, U* and *V*.

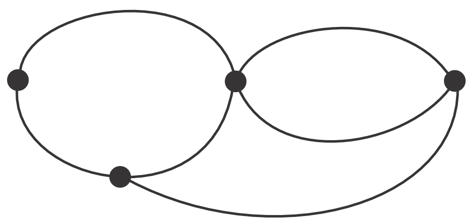


The shortest path through the parkland from *P* to *V* could be found using

A. critical path analysis.
B. a minimum cut.
C. Prim's algorithm.
D. a spanning tree.
E. Dijkstra's algorithm.

Question 34

Consider the graph below.

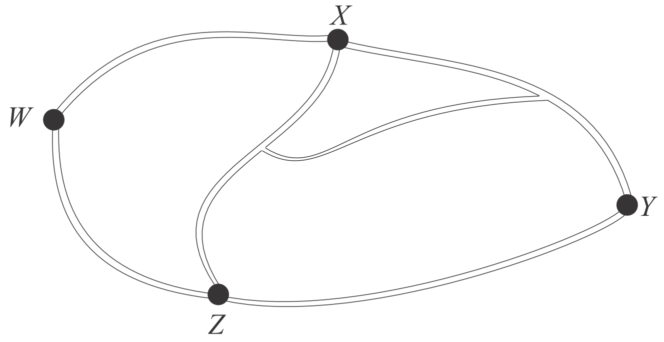


This graph

A. contains a loop.
B. has a bridge.
C. is complete.
D. is planar.
E. is a tree.

Question 35

A map of the roads connecting the towns W, X, Y and Z is shown below.



The adjacency matrix that could represent these road connections is

A. $\begin{array}{c} \\ W \\ X \\ Y \\ Z \end{array}\begin{array}{c} \begin{array}{cccc} W & X & Y & Z \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 1 & 2 & 2 \\ 0 & 2 & 0 & 2 \\ 1 & 2 & 2 & 0 \end{bmatrix} \end{array}$

B. $\begin{array}{c} \\ W \\ X \\ Y \\ Z \end{array}\begin{array}{c} \begin{array}{cccc} W & X & Y & Z \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 2 & 2 \\ 0 & 2 & 0 & 2 \\ 1 & 2 & 2 & 0 \end{bmatrix} \end{array}$

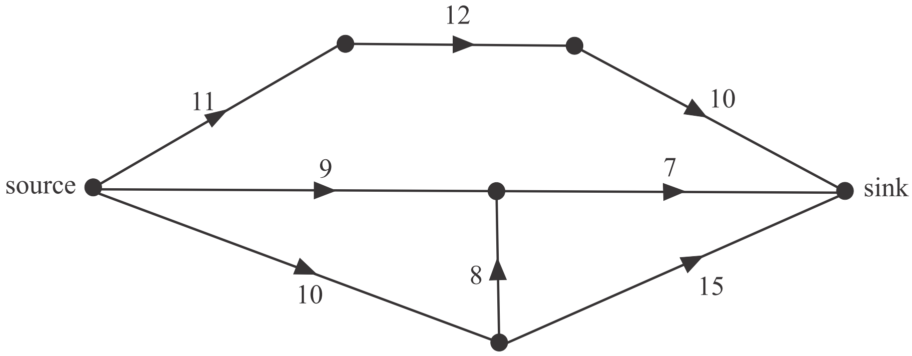
C. $\begin{array}{c} \\ W \\ X \\ Y \\ Z \end{array}\begin{array}{c} \begin{array}{cccc} W & X & Y & Z \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \end{array}$

D. $\begin{array}{c} \\ W \\ X \\ Y \\ Z \end{array}\begin{array}{c} \begin{array}{cccc} W & X & Y & Z \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 1 & 2 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$

E. $\begin{array}{c} \\ W \\ X \\ Y \\ Z \end{array}\begin{array}{c} \begin{array}{cccc} W & X & Y & Z \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 2 \\ 0 & 1 & 1 & 2 \\ 1 & 2 & 2 & 0 \end{bmatrix} \end{array}$

Question 36

The graph below shows the flow of waste water, in litres per minute, through a system of pipes which connect the source to the sink.

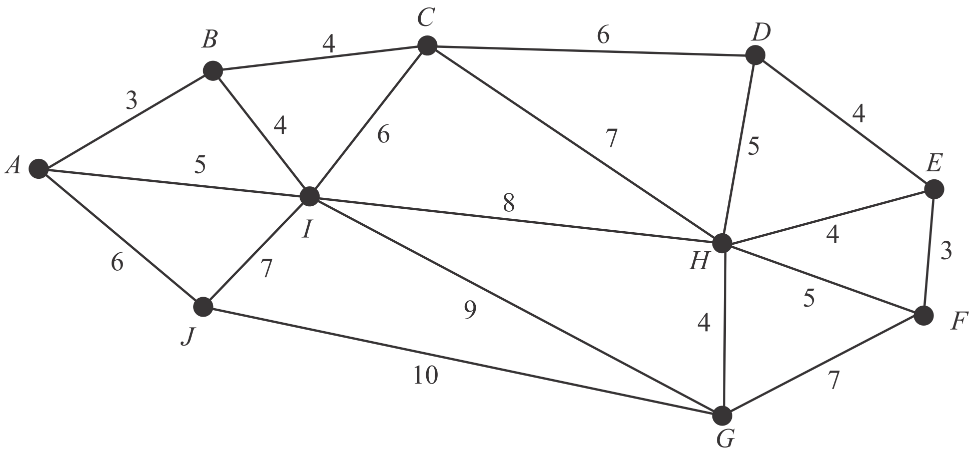


The maximum flow possible, in litres per minute, from the source to the sink is

A. 26
B. 27
C. 29
D. 30
E. 32

Question 37

The network below shows the distance, in metres, between garden lights that are being installed.
The vertices A to J represent the garden lights.

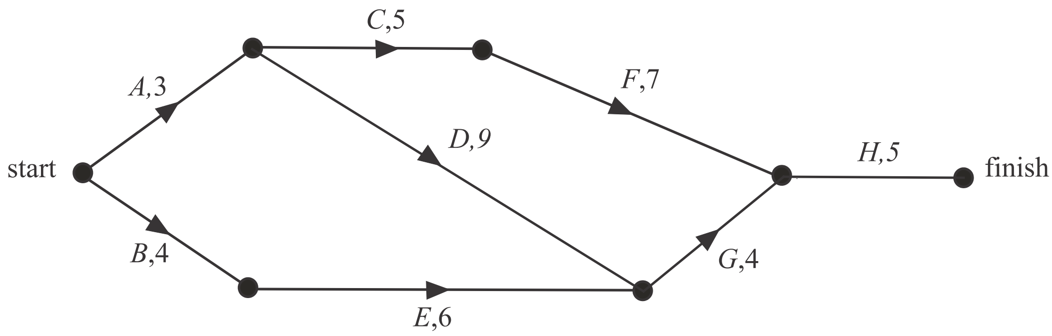


The minimum length of cable, in metres, required to connect all the garden lights is

A. 37
B. 38
C. 39
D. 41
E. 43

Question 38

The network below shows the sequence of activities $A - H$ that are required to complete a project.
The duration of each activity, in days, is also shown on the network.



The project is to be completed in the minimum time possible.
What is the latest start time (LST) for activity B, in days, so that the project is completed in the minimum time possible?

A. 0
B. 1
C. 2
D. 3
E. 4

Question 39

The table below shows the seven activities *A* – *G*, required to complete a project.
The immediate predecessor(s) of each activity is also shown.

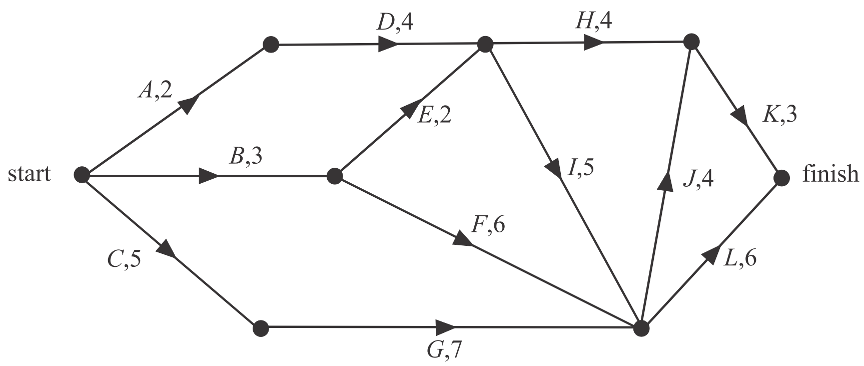
Activity	Immediate predecessor(s)
A	-
B	-
C	*A*
D	*B*
E	*C, D*
F	*D*
G	*E, F*

The directed network representing this project will require a dummy activity.
The dummy activity will be drawn from the end of

A. activity *C* to the start of activity *E*.
B. activity *C* to the start of activity *F*.
C. activity *D* to the start of activity *E*.
D. activity *D* to the start of activity *F*.
E. activity *E* to the start of activity *F*.

Question 40

The directed graph below shows a sequence of 12 activities required to complete a building project. The time to complete each activity, in weeks, is also shown.



The owner of the building wants the project to be completed in no more than 16 weeks.
The duration of activities *D, E, G, J, K* and *L* can each be reduced by one week, at a cost of $1000 per activity. The least cost to reduce the completion time of the project to 16 weeks is

A. $3000
B. $4000
C. $6000
D. $7000
E. $9000

General Mathematics formulas

Data analysis

standardised score	$z = \dfrac{x - \bar{x}}{s_x}$
lower and upper fence in a boxplot	lower $\mathrm{Q}_1 - 1.5 \times \mathrm{IQR}$ upper $\mathrm{Q}_3 + 1.5 \times \mathrm{IQR}$
least squares line of best fit	$y = a + bx$, where $b = r\dfrac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$
residual value	residual value = actual value – predicted value
seasonal index	seasonal index $= \dfrac{\text{actual figure}}{\text{deseasonalised figure}}$

Recursion and financial modelling

first-order linear recurrence relation	$u_0 = a, \quad u_{n+1} = Ru_n + d$
effective rate of interest for a compound interest loan or investment	$r_{effective} = \left[\left(1 + \dfrac{r}{100n}\right)^n - 1\right] \times 100\%$

Matrices

determinant of a 2×2 matrix	$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, $\det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$
inverse of a 2×2 matrix	$A^{-1} = \dfrac{1}{\det A}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$, where $\det A \neq 0$
recurrence relation	$S_0 =$ initial state, $S_{n+1} = TS_n + B$
Leslie matrix recurrence relation	$S_0 =$ initial state, $S_{n+1} = L\,S_n$

Networks and decision mathematics

Euler's formula	$v + f = e + 2$

END OF FORMULA SHEET

GENERAL MATHEMATICS UNITS 3&4

TRIAL EXAMINATION 1

MULTIPLE-CHOICE ANSWER SHEET

STUDENT NAME ……………………………

INSTRUCTIONS

Fill in the letter that corresponds to your choice. Example: A ■ C D E
The answer selected is B. Only one answer should be selected.

1.	A	B	C	D	E
2.	A	B	C	D	E
3.	A	B	C	D	E
4.	A	B	C	D	E
5.	A	B	C	D	E
6.	A	B	C	D	E
7.	A	B	C	D	E
8.	A	B	C	D	E
9.	A	B	C	D	E
10.	A	B	C	D	E
11.	A	B	C	D	E
12.	A	B	C	D	E
13.	A	B	C	D	E
14.	A	B	C	D	E
15.	A	B	C	D	E
16.	A	B	C	D	E
17.	A	B	C	D	E
18.	A	B	C	D	E
19.	A	B	C	D	E
20.	A	B	C	D	E
21.	A	B	C	D	E
22.	A	B	C	D	E
23.	A	B	C	D	E
24.	A	B	C	D	E
25.	A	B	C	D	E
26.	A	B	C	D	E
27.	A	B	C	D	E
28.	A	B	C	D	E
29.	A	B	C	D	E
30.	A	B	C	D	E
31.	A	B	C	D	E
32.	A	B	C	D	E
33.	A	B	C	D	E
34.	A	B	C	D	E
35.	A	B	C	D	E
36.	A	B	C	D	E
37.	A	B	C	D	E
38.	A	B	C	D	E
39.	A	B	C	D	E
40.	A	B	C	D	E