Neap

Trial Examination 2022

QCE General Mathematics Units 3&4

Paper 1

SECTION 1 – MULTIPLE CHOICE QUESTIONS

	A	B	C	D
1.	○	●	○	○
2.	○	○	●	○
3.	●	○	○	○
4.	○	○	○	●
5.	○	●	○	○
6.	○	●	○	○
7.	○	○	○	●
8.	○	●	○	○
9.	○	○	○	●
10.	●	○	○	○
11.	○	○	●	○
12.	○	●	○	○
13.	○	●	○	○
14.	○	○	●	○
15.	○	○	●	○
16.	○	○	○	●
17.	●	○	○	○
18.	○	●	○	○
19.	●	○	○	○
20.	○	○	●	○

QUESTION 1   B

B is correct. Blood pressure and body weight are two numerical variables that can be measured to determine whether an association exists.

A, **C** and **D** are incorrect. These situations are examples of univariate data that is used to find the median, mode and mean, respectively.

QUESTION 2   C

C is correct. Using a calculator gives the *r* value of 0.965941…, which rounds to 0.966.

A is incorrect. This option gives the value for the gradient, *b*.

B is incorrect. This option has been incorrectly rounded.

D is incorrect. This option gives the value of the *y*-intercept, *a*.

QUESTION 3   A

A is correct. The graph can be described as follows: strong, as the data points are close together; negative, as when *x* increases, *y* decreases; and non-linear, as the data points are in a curved pattern.

B, **C** and **D** are incorrect. These options do not correctly describe the graph.

QUESTION 4   D

D is correct. Height and IQ are not causally related; therefore, any association would be considered a coincidence.

A, **B** and **C** are incorrect. The bivariate data variables in each of these examples would be causally related, not a coincidence.

QUESTION 5   B

B is correct. The seasonal indices should add up to 7, as there are seven days in a week.

$7 - (0.62 + 0.71 + 0.75 + 1.35 + 1.46 + 1.22) = 0.89$

A is incorrect. This option adds and divides the values by 7.

C is incorrect. This option is the seasonal index of 1.

D is incorrect. This option adds all the values together.

QUESTION 6   B

B is correct. The four-point moving average is calculated by taking the five values centred around day 5 (days 3–7), averaging the first four (days 3–6), averaging the last four (days 4–7) and then averaging these two results. For example:

$$\frac{\text{day 3} + \text{day 4} + \text{day 5} + \text{day 6}}{4} = \frac{4500 + 3500 + 2800 + 3600}{4}$$
$$= 3600$$

$$\frac{\text{day 4} + \text{day 5} + \text{day 6} + \text{day 7}}{4} = \frac{3500 + 2800 + 3600 + 4200}{4}$$
$$= 3525$$

$$\text{centring} = \frac{3600 + 3525}{2}$$
$$= 3562.5$$

A is incorrect. This option is the value at day 5.

C is incorrect. This option is the five-point moving average of day 5.

D is incorrect. This option adds the five values centred at day 5 and divides them by 4.

QUESTION 7   D

D is correct. By substituting t_1 into t_0, the calculation for t_2 is $5 \times 4 - 20 = 0$.

A is incorrect. $5 \times 3 + 4 = 19$

B is incorrect. $5 \times 2 - 40 = -30$

C is incorrect. $5 \times 0.5 + 100 = 102.5$

QUESTION 8   B

B is correct. The prime meridian is approximately the same shape as the International Date Line; however, it is positioned on the opposite side of Earth.

A is incorrect. A great circle is a full circle around Earth; the International Date Line only reaches from the North Pole to the South Pole.

C is incorrect. A parallel of latitude is located on a small circle around Earth that is perpendicular to the International Date Line.

D is incorrect. The equator is a great circle that exists perpendicular to the International Date Line.

QUESTION 9   D

D is correct. This option is calculated using the distance formula for two places on Earth that are on the same meridian.

$$\text{angular distance} = 51°15' + 33°27'$$
$$= 84°42'$$

$$D = 111.2 \times \text{angular distance}$$
$$= 111.2 \times 84°42'$$
$$= 9418.64 \text{ km}$$

A is incorrect. This option is calculated using the $\cos\theta$ formula for two places on Earth that are on the same parallel of latitude.

B is incorrect. This option is calculated using the correct formula but with $70°43'$ as the angular distance.

C is incorrect. This option is calculated using the correct formula but does not convert the solution into kilometres to find the distance.

QUESTION 10   A

A is correct. The 31st of December is during daylight saving in Tasmania, so Tasmania will be one hour ahead of Queensland. If the time is 11:59 pm in Tasmania, it will be 10:59 pm in Queensland.

B is incorrect. This option is the same time that Thomas calls; however, Tasmania observes daylight saving time for 6 months between October and April, which covers the 31st of December.

C is incorrect. This option assumes that Queensland is ahead of Tasmania by one hour, which is incorrect.

D is incorrect. This option assumes that Queensland is ahead of Tasmania by two hours, which is incorrect.

QUESTION 11   C

C is correct. New York is three hours ahead of Los Angeles ($-5 - -8 = 3$). Therefore, the time in Los Angeles at the upload of the video is 3:20 pm. If the subscriber watches the video an hour after it is uploaded, the time will be 4:20 pm in Los Angeles.

A is incorrect. This option is incorrectly calculated to be an hour before the upload.

B is incorrect. This option does not take into account the subscriber watching the video an hour after it is uploaded.

D is incorrect. Los Angeles has been incorrectly calculated to be three hours ahead of New York and the hour after upload has been applied.

QUESTION 12   B

B is correct.

$A = \$23\,800$

M = amount of each payment required to bring the balance to $0

$i = \dfrac{\dfrac{4.83}{26}}{100}$

$ = 0.00185769\ldots$

$n = 4.5 \times 26$

$ = 117$ fortnights

$$A = M\left(\frac{1-\left(1+i\right)^{-n}}{i}\right)$$

$$23\,800 = M\left(\frac{1-\left(1+0.00185769\ldots\right)^{-117}}{0.00185769\ldots}\right)$$

$$\frac{23\,800}{\dfrac{1-\left(1+0.00185769\ldots\right)^{-117}}{0.00185769\ldots}} = M$$

$$M = 226.51366\ldots$$
$$M \approx \$226.51$$

Note: If exact values or fractions are not used for the interest rate, the result will not be accurate.

A is incorrect. This option uses the future value annuity formula rather than the present value annuity formula.

C is incorrect. This option does not divide the interest rate by 26 fortnights a year.

D is incorrect. This option does not multiply the n value by 26.

QUESTION 13   B

B is correct.

$A = 69\,000$

$P = 49\,000$

$i = ?$

$n = 15 \times 4$

$\quad = 60$ quarters

$$A = P(1+i)^n$$

$$69\,000 = 49\,000(1+i)^{60}$$

$$\frac{69\,000}{49\,000} = (1+i)^{60}$$

$$\sqrt[60]{\frac{69\,000}{49\,000}} = 1+i$$

$$\sqrt[60]{\frac{69\,000}{49\,000}} - 1 = i$$

$$i = 0.005721\ldots$$

Multiplying by 4 to convert from quarterly interest rate to annual interest rate, then multiplying by 100 to convert from a decimal to a percentage gives:

$i = 0.005721\ldots \times 4 \times 100$

$\quad = 2.2884\ldots\%$ p.a.

$\quad \approx 2.29\%$ p.a.

A is incorrect. This option is incorrectly rounded.

C is incorrect. This option uses 15 years as the *n* value rather than converting the years to quarters, and is incorrectly rounded down.

D is incorrect. This option uses 15 years as the *n* value rather than converting the years to quarters.

QUESTION 14   C

C is correct.

$$i_{\text{effective}} = \left(1 + \frac{i}{n}\right)^n - 1$$

$$= \left(1 + \frac{\frac{2.87}{100}}{365}\right)^{365} - 1$$

$$= 0.0291146\ldots \times 100$$

$$= 2.91\% \text{ p.a.}$$

A is incorrect. This option does not consider that the interest compounds daily.

B is incorrect. This option uses the *n* value of 4 instead of 365.

D is incorrect. This option is incorrectly rounded up.

QUESTION 15   C

C is correct.

$A = \$130\,000$

$M = ?$

$$i = \frac{\dfrac{3.91}{2}}{100}$$
$$= 0.01955$$

$$A = \frac{M}{i}$$
$$130\,000 = \frac{M}{0.01955}$$
$$M = \$2541.50$$

A is incorrect. This option divides 3.91% p.a. by 12 instead of 2.

B is incorrect. This option divides 3.91% p.a. by 4 instead of 2.

D is incorrect. This option may be reached if 130 000 is divided, not multiplied, by 0.01955.

QUESTION 16   D

D is correct. A semi-Eulerian trail must traverse every edge in the network and contain exactly two vertices of odd degree. Vertex A and vertex G are both degree three due to three edges leaving their vertex.
This means the semi-Eulerian trail must start at one and end at the other.
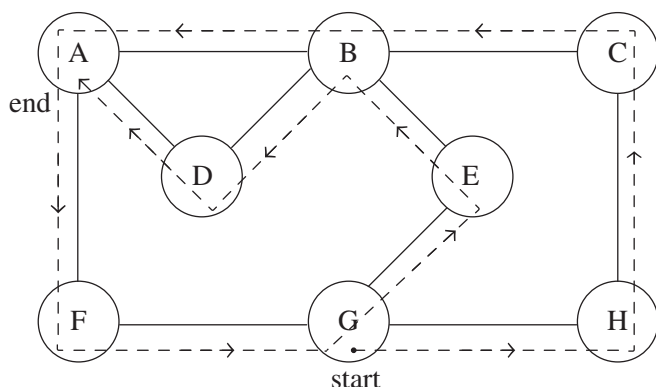
A is incorrect. This option starts and ends at the same vertex and traverses some edges multiple times.

B is incorrect. This option starts at an odd-degree vertex, but it ends at an even-degree vertex and traverses A–B twice.

C is incorrect. This option starts and ends at the same vertex and does not traverse every edge.

QUESTION 17   A

A is correct. When redrawn as a planar graph, the diagram would become a circular shape with two faces, one inside the line and one outside the line.
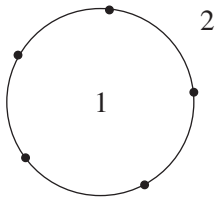
B is incorrect. This option incorrectly counts three faces.

C is incorrect. This option may be reached if the diagram is not redrawn and only the inner faces are counted.

D is incorrect. This option may be reached if the diagram is not redrawn and all the faces are counted.
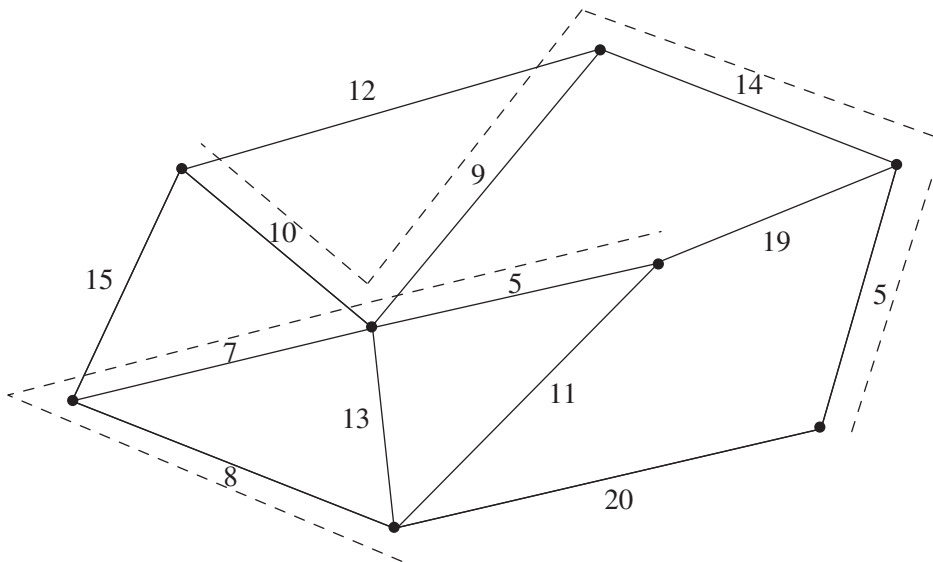
QUESTION 18   B

B is correct. The term closed refers to a walk, path or trail that starts and ends at the same vertex. In a path, no vertices and no edges are repeated (except the first and last vertex if it is a closed path). These criteria fit D–G–J–I–F–C–A–B–E–D.

A, **C** and **D** are incorrect. The term open refers to a walk, path or trail that starts and ends at different vertices. In a walk, the edges and vertices may be repeated. In a trail, no edges are repeated but vertices may be repeated.

QUESTION 19   A

A is correct. Using Prim's algorithm (starting at one vertex and highlighting the lowest value edges connecting to each vertex without creating a cycle):
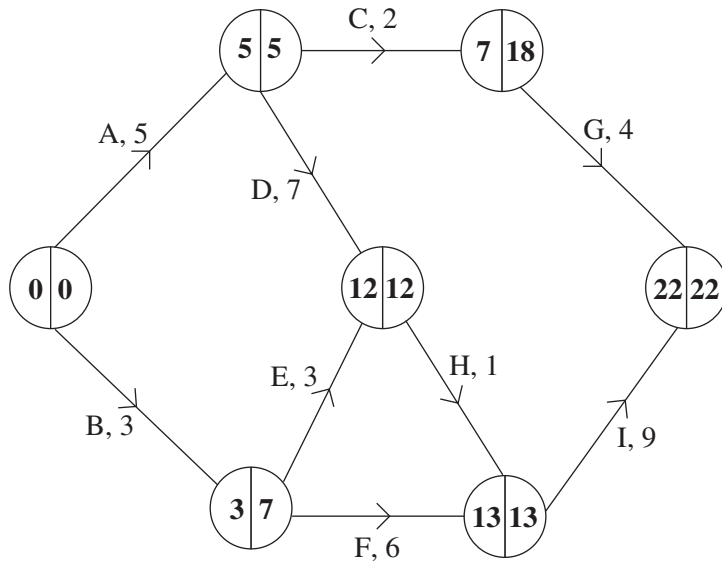
$5 + 7 + 9 + 10 + 8 + 14 + 5 = 58$

B, **C** and **D** are incorrect. The lowest value edges are not correctly chosen.

QUESTION 20   C

C is correct. When performing a forward and backward scan, the float time for Activity F is determined by $13 - 3 - 6 = 4$.

A is incorrect. No float time would indicate that Activity F is on the critical path.

B is incorrect. This option is the float time for Activity E.

D is incorrect. This option is the activity time for Activity F.

SECTION 2

QUESTION 21   (4 marks)

a)

	Primary school (%)	**High school (%)**
Change tuckshop menu	46.43	46
Keep tuckshop menu	53.57	54
Total	100	100

[2 marks]
1 mark for converting each column to the correct percentages.

b)   There is no association.

The **difference** in percentages between primary school and high school students who want to change the tuckshop menu is **minimal** (46.43% compared to **46%**). There is also a very small difference between primary school and high school students who want to keep the tuckshop menu (53.57% compared to **54%**).

[2 marks]
1 mark for stating that there is no association.
1 mark for justifying the answer by stating relevant percentages.
Note: Accept one comparison. Allow follow-through errors. Accept rounding to whole values.

QUESTION 22   (5 marks)

a) $b = r\dfrac{s_y}{s_x}$

$= 0.9176 \times \dfrac{29.99}{10.63}$

$= 2.588788\ldots$

$a = \overline{y} - b\overline{x}$

$= 254.6 - 2.588788\ldots \times 28.1$

$= 181.855\ldots$

≈ 181.9

$y = a + bx$

$= 181.9 + 2.6x$

[3 marks]
1 mark for calculating b.
1 mark for calculating a.
1 mark for stating the equation in $y = a + bx$ or equivalent form.

b)   i)   The *y*-intercept means that 181.9 micrograms of plant hormone is emitted when the plant is 0 cm tall.
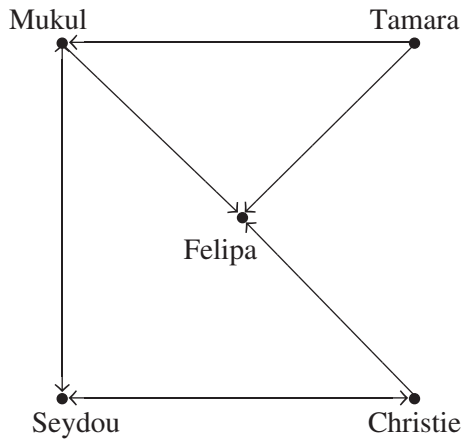
[1 mark]
1 mark for interpreting the y-intercept.

ii)   The gradient/slope means that the plant emits 2.6 micrograms of plant hormone for every 1 cm of plant growth.

[1 mark]
1 mark for interpreting the gradient/slope.

QUESTION 23   (3 marks)

[3 marks]
1 mark for drawing two edges with arrows on both ends that join Christie to Seydou and Seydou to Mukul.
1 mark for drawing two edges with arrows on one end that join Christie to Felipa and Tamara to Felipa.
1 mark for drawing two edges with arrows on one end that join Tamara to Mukul and Mukul to Felipa.

QUESTION 24   (3 marks)

a)   E

[1 mark]
1 mark for identifying the correct vertex.

b)   A and D

[1 mark]
1 mark for identifying the correct vertices.

c)   G

[1 mark]
1 mark for identifying the correct vertex.

QUESTION 25   (4 marks)

$A = 2000 + 600$

$\quad = \$2600$

$P = \$2000$

$i = \dfrac{\dfrac{3.15}{12}}{100}$

$\quad = 0.002625$

$A = P(1+i)^n$

$2600 = 2000(1 + 0.002625)^n$

$1.3 = 1.002625^n$

Using trial and error:

$1.002625^5 = 1.0131\ldots$ (too low)

$1.002625^{200} = 1.6892\ldots$ (too high)

$1.002625^{100} = 1.2997\ldots$ (too low)

$1.002625^{101} = 1.3031\ldots$ (just over the required value)

It will take 101 months to reach $2600.

$\dfrac{101}{12} = 8.41666\ldots$ years

$0.41666\ldots \times 12$ months $\approx$ 5 months

Therefore, it will take **8 years and 5 months** to receive $2600, which is $600 of interest.

[4 marks]
1 mark for determining the values of A and i.
1 mark for substituting into the compound interest rule.
1 mark for determining the number of months.
1 mark for determining the number of years and months.
Note: The values for A and i may be implied by subsequent working.
Accept follow-through errors.

QUESTION 26   (5 marks)

$$
\begin{array}{c}
\quad\ A\ \ B\ \ C\ \ D\ \ E \\
\begin{array}{c}A\\B\\C\\D\\E\end{array}
\begin{bmatrix}
1 & 2 & 1 & 0 & 0 \\
2 & 0 & 1 & 1 & 0 \\
1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 3 \\
0 & 0 & 0 & 3 & 2
\end{bmatrix}
\end{array}
$$

[5 marks]
1 mark for each correct row.
Note: Accept answers written as a table and with the towns given in a different order.

QUESTION 27   (4 marks)

$\text{angular distance} = 142°25' + 113°56'$

$\qquad\qquad\qquad = 256°21'$

$\text{shortest angular distance} = 360° - 256°21'$

$\qquad\qquad\qquad\qquad\quad = 103°39'$

$D = 111.2\cos\theta \times \text{angular distance}$

$\quad = 111.2\cos(50°05') \times 103°29'$

$\quad = 7395.84 \text{ km}$

[4 marks]
1 mark for calculating the angular distance.
1 mark for calculating the shortest angular distance.
1 mark for substituting into the correct distance formula.
1 mark for calculating the shortest distance.
Note: Accept follow-through errors and equivalent answers.

QUESTION 28   (2 marks)

$t_0 = 24\,000,\ t_{n+1} = 0.75t_n$

[2 marks]
1 mark for stating the starting value.
1 mark for stating that the nth term is multiplied by 0.75.
Note: Accept equivalent formats.

QUESTION 29   (6 marks)

a)   There are 18 different cuts possible on the flow network.

   $10 + 12 + 13 = 35$

   $10 + 12 + 9 = 31$

   $10 + 12 + 8 = 30$

   $10 + 7 + 13 = 30$

   $10 + 7 + 9 = 26$

   $10 + 8 = 18$

   $15 + 12 + 13 = 40$

   $15 + 12 + 9 = 36$

   $15 + 12 + 8 = 35$

   $15 + 7 + 13 = 35$

   $15 + 7 + 9 = 31$

   $15 + 8 = 23$

   $5 + 12 + 13 = 30$

   $5 + 12 + 9 = 26$

   $5 + 12 + 8 = 25$

   $5 + 7 + 13 = 25$

   $5 + 7 + 9 = 21$

   $5 + 8 = 13$

[4 marks]
1 mark for identifying that there are 18 possible cuts.
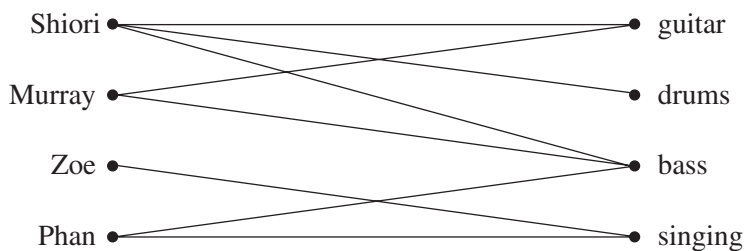*3 marks for showing the value of each cut.*

b)   The minimum cut is $5 + 8 = 13$; therefore, the maximum flow is 13 litres.

[2 marks]
1 mark for calculating the minimum cut.
1 mark for stating the maximum flow.

QUESTION 30   (4 marks)

Zoe should sing, Phan should play bass, Shiori should play drums and Murray should play guitar.

[4 marks]
1 mark for using the correct bipartite graph drawing conventions.
1 mark for drawing the edges joining vertices.
2 marks for determining which person can be allocated to each task.

TEQGM34_SS_P1_2022