VCE School Assessed Coursework: SAC

Students Name:

Sacred Heart College Yarrawonga

VCE Study:	General Mathematics
Unit:	4
Outcomes:	1, 2 and 3
Assessment Task	Matrices Modelling Task
Date:	Tuesday 23rd July (A) & Wednesday 24th July (B)
Time:	10 mins reading 50 mins writing
Instructions:	Students to answer all questions in the spaces provided. **Round to two decimal places unless instructed otherwise**
Conditions:	Silent, individual work
Permitted Materials:	Pens, Pencils, Ruler, Eraser, TIInspire CAS calculator, Bound Notes
Marks allocated:	/46

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the room.

I understand I must not intentionally or unintentionally disclose any details on this SAC or imply what is or is not included, or in any way gain an unfair advantage for myself over other

students. If I do, I understand that disciplinary action will occur and my result will be downgraded. In fairness to fellow students it is my responsibility to inform the VCE office if I am aware that information about the SAC is being passed on, or that a student has gained unfair advantage.

Student Signature: Date:

Part 1 – 18 marks

The Melbourne Cricket Club (MCC) offers 3 types of membership, **Full Membership (F), Restricted Membership (R) and Provisional Membership (P).**

Members can nominate their preferred AFL club when renewing their membership each year.

Members of the following AFL clubs made up the number of membership types at the end of the 2023 year.

Their type of memberships and the club they follow is shown in the table below:

Clubs	Provisional Membership	Restricted Membership	Full membership
Collingwood	4139	1213	3449
Carlton	22762	1425	5860
Essendon	15461	3647	7582
Melbourne	20069	9410	12069

a) Construct a labelled **matrix, M,** which can be used to represent the number of members in each membership tier for these 4 clubs. (2 marks)

M =

	P	R	F
Collingwood			
Carlton			

Essendon

Melbourne

b) State the order of Matrix M. (1 mark)

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c) Interpret the element m_{23}

(1 mark)

d) How many Melbourne full members are there?

(1 mark)

e) What is the total number of Collingwood members?

(1 mark)

f) How many provisional members are there in total?

(1 mark)

g) Use a summing matrix to find the total memberships in each club. Show your working out.

(2 marks)

The yearly cost for a country membership is indicated below:

Provisional	$465

Restricted	$294
Full	$593

Each club would like data on their members. This should include the income from the memberships for each club, and the total number of members for each club.

Show the above information as Matrix C.

C=

h) What is the order of matrix C?

_____

_____

(1 mark)

i) Can I multiply matrix M by matrix C? Give reasons as to why/why not?

_____

_____

_____

(2 marks)

j) Multiply Matrix M by matrix C so that the resultant matrix gives the membership revenue for each club.

_____

(2 marks)

k) Use your information to write a short report on each club.

(2 marks)

l) Select one of the clubs. Calculate the percentage of members who have a Full membership.

(2 marks)

Part 2 – 16 marks

There are several dining options for MCC members and their guests at football games.

- The **Jim Stynes Grill (J)**
- The **Committee Room by Grossi (C)**
- The **Trumble Bar and Café (T)**

The Committee spent time looking at the dining trends of patrons. They found:

- 22% of members who at the Jim Stynes Grill on one week, dined there the next week, whilst 38 % of them attended the Committee Room for their next meal and 40% of them attended the Trumble Bar
- 48% of those eating at the Committee Room ate there the next week, 12% will eat at the Jim Stynes Grill and 40% will eat at the Trumble Bar
- 60% of those that ate at the Trumble Bar will eat there next week, 27% will eat at the Jim Stynes Grill Bar and the rest will eat at the Committee Room

a) Represent this information in a labelled matrix T

$$T = \begin{matrix} \\ \text{Next Week} \\ \text{Vis} \end{matrix} \begin{matrix} \text{Initial Visit} \\ \begin{matrix} J & C & T \end{matrix} \end{matrix} \begin{bmatrix} 0.22 & 0.12 & 0.27 \\ 0.38 & 0.48 & 0.60 \end{bmatrix} \begin{matrix} J \\ C \\ T \end{matrix}$$

Initially the following numbers were found to be in the restaurants

- 140 in the Jim Stynes Bar
- 320 in the Committee Room
- 360 in the the Hugh Trumble Bar

(3 marks)

b) Represent this information as the initial state matrix, $\mathbf{S_0}$

_____

_____

_____

(2 marks)

c) **Show recursively** the number of people in each venue on the next two occasions. (S_1 and S_2)

(4 marks)

d) How many people attended the Hugh Trumble Bar on Week 10?

(2 marks)

e) In the long term, what was the most popular venue? (Show setting out including proof of the long term behaviour)

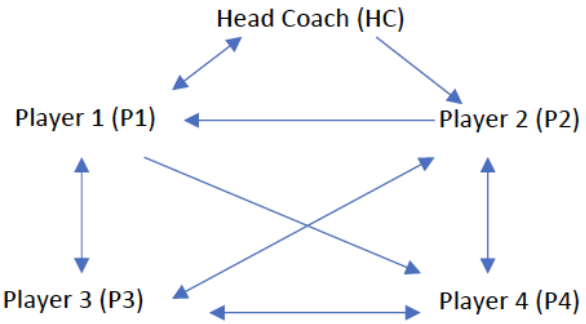
(3 marks)

f) Of those that attended the Hugh Trumble Bar in Week 4, what percentage had attended Jim Stynes the previous week?

(2 marks)

Part 3 – 12 marks

The Essendon football club did not seem to play well at the MCG. This was due to communication issues from coach to players. Below is a communication diagram to illustrate the communication between the Head Coach and four of the senior players



a) i) What does the line between the Head Coach and Player 2 represent?

_____

_____

(1 mark)

ii) How is this different from the line between the Head Coach and Player 1?

_____

_____

(1 mark)

iii) Complete the communication matrix (3 marks)

Receiver

HC P1 P2 P3 P4

HC
P1
C= **P2** **Sender**

P3

P4

b) Added to the communication issues, there was a disagreement amongst those same four players as to whom was the best, and therefore should be captain. Player 1 presented the other players with the following dominance matrix, D, to show who should be captain.

$$D = \begin{matrix} \\ P1 \\ P2 \\ P3 \\ P4 \end{matrix} \begin{matrix} \overset{loser}{\begin{matrix} P1 & P2 & P3 & P4 \end{matrix}} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{matrix} \overset{winner}{}$$

i. Complete the diagram below, based on the matrix D.

P1 P2

P3 P4

(2 marks)

c) Who if anyone does player 4 have two step dominance over?

_____

_____

_____

(1 mark)

d) Player 1 says that matrix D proves she should be captain by being the most dominant player. By first finding the total dominance matrix, **T (total of one and two step dominance)**, show that she is correct.

(4 marks)