PART OF THE UNIVERSITY
OF WOLLONGONG AUSTRALIA
GLOBAL NETWORK

School of Computing & Creative Media

Department of Computing

Bachelor of Software Engineering (Hons)

Bachelor of Computer Science (Hons)

Discrete Mathematics

XBCS1103N

July / September 2023 Semester

Group Assignment 2

15%

INSTRUCTIONS:

1. This is a group assignment, form a group of 2 members.
2. The assignment due date is 1st December 2023 (week 12), 4pm.

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Submission instructions

- Cover sheet to be attached to the front of the assignment.
- All pages to be numbered sequentially

Instructions

This is a group assignment carrying 15% of the total marks for this module.

Submit your assignment in hard copy and soft copy (convert to pdf). Make sure name and ID is written on the cover sheet.

Format of the report:

1. Font size: 14 point for title/heading, 12 point for contents and 8-9 point forheaders/footers
2. Font face: Arial
3. Line spacing: 1.5
4. Proper alignment of your paragraphs, and necessary page set-up.

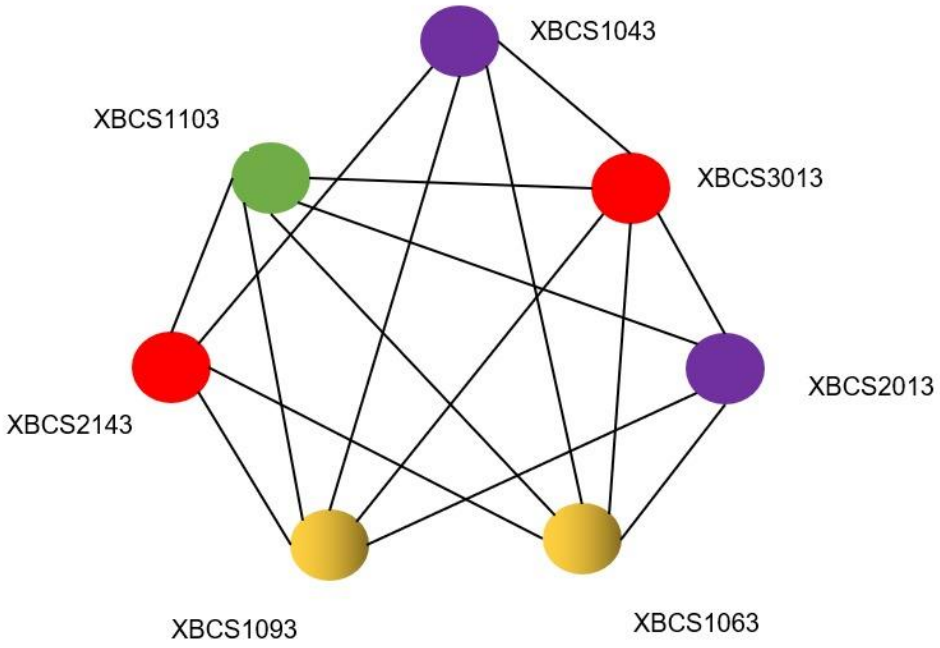
Marks will be deducted for late submission. 2 marks for each day late from the totalmarks gained.

Questions: Answer all the questions.

Question 1

Schedule the final exams for XBCS1043, XBCS1103, XBCS2143, XBCS1093, XBCS1063, XBCS2013 and XBCS3013, using the fewest number of different time slots, if there are no students taking both XBCS1043 and XBCS1103, both XBCS2143 and XBCS3013, both XBCS1093 and XBCS1063, both XBCS2013 and XBCS1043, both XBCS2143 and XBCS2013, but there are students in every other pair of courses. You need to include graph presenting the scheduling final exams and also a colouring to schedule final exams.

Subjects	Pair
XBCS1043	XBCS2143, XBCS1093, XBCS1063, XBCS3013
XBCS1103	XBCS2143, XBCS1093, XBCS1063, XBCS2013, XBCS3013
XBCS2143	XBCS1043, XBCS1103, XBCS1093, XBCS1063
XBCS1093	XBCS1043, XBCS1103, XBCS2143, XBCS2013, XBCS3013
XBCS1063	XBCS1043, XBCS1103, XBCS2143, XBCS2013, XBCS3013
XBCS2013	XBCS1103, XBCS1093, XBCS1063, XBCS3013
XBCS3013	XBCS1043, XBCS1103, XBCS1093, XBCS1063, XBCS2013



4 different colour used in the graph to represent the time slots.

Time slot 1: XBCS1043, XBCS2013

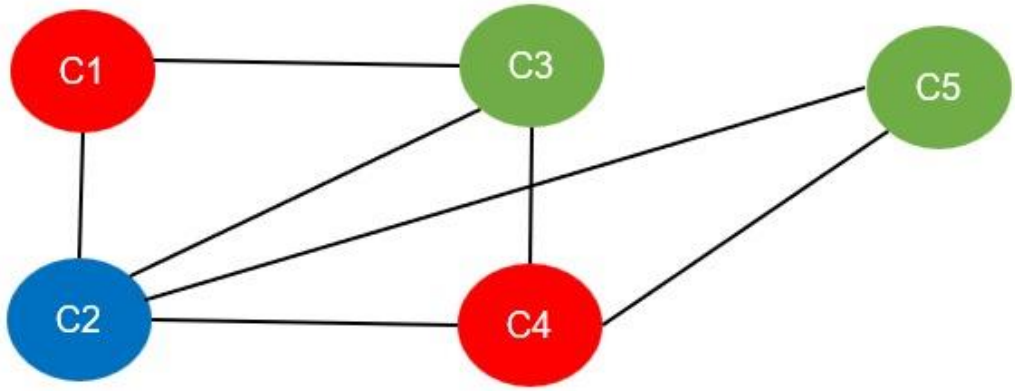
Time slot 2: XBCS1103

Time slot 3: XBCS2143, XBCS3013

Time slot 4: XBCS1093, XBCS1063

Question 2

The mathematics department has five committees, each meeting once a month. How many different meeting times must be used to ensure that no member is scheduled to attend two meetings at the same time if the committees are C1 = {Ali, Balan}, C2 = {Balan, Lee, John}, C3 = { Ali, John, Zakir}, C4 = {Lee, John, Zakir}, and C5 = {Brand, Rosen, Lee}? You need to include graph presenting the scheduling meeting time and also a colouring to schedule meeting time.



3 different colors used int the graph to represent 3 meetings.

Time slot 1: C1 and C4

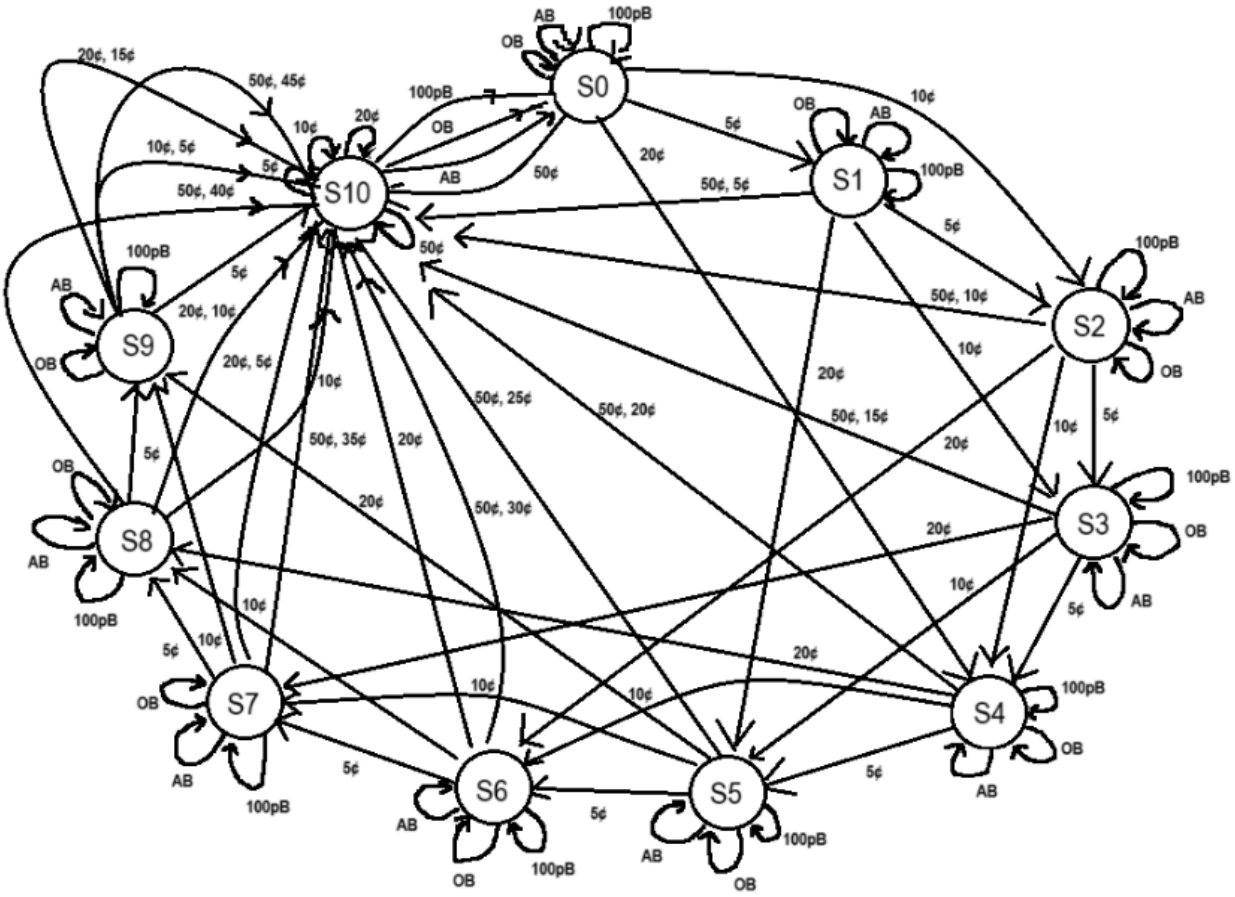
Time slot 2: C3 and C5

Time slot 3: C2

Question 3

Constructing a finite state machine involves defining states, transitions, and the behavior associated with each state. In this case, the states will represent the amount of money inserted into the soda machine, and the transitions will represent the acceptance of different coins. Additionally, we need to define states for giving change and the different beverage options.

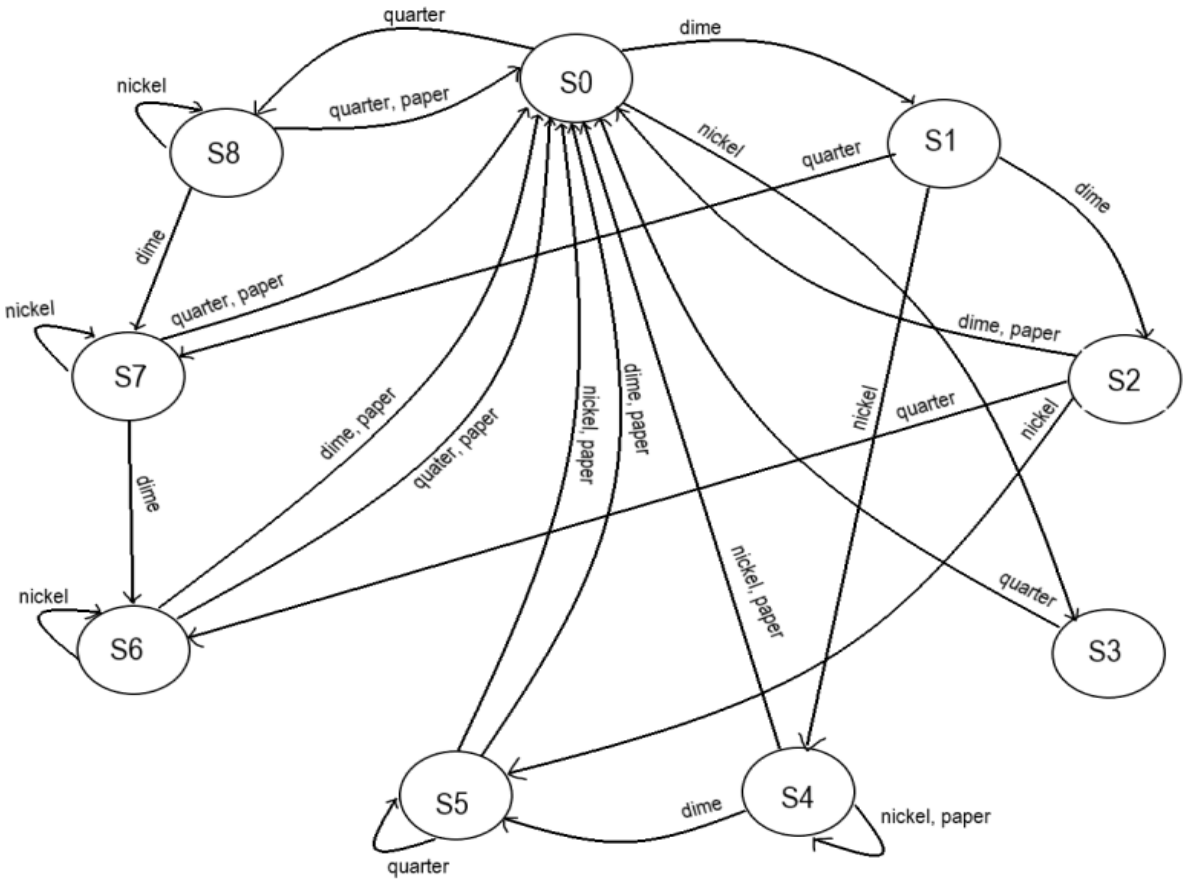
States	5¢	10¢	20¢	50¢	100pB	AB	OB	5¢	10¢	20¢	50¢	100pB	AB	OB
S0	S1	S2	S4	S10	S0	S0	S0	-	-	-	-	-	-	-
S1	S2	S3	S5	S10	S1	S1	S1	-	-	-	5¢	-	-	-
S2	S3	S4	S6	S10	S2	S2	S2	-	-	-	10¢	-	-	-
S3	S4	S5	S7	S10	S3	S3	S3	-	-	-	15¢	-	-	-
S4	S5	S6	S8	S10	S4	S4	S4	-	-	-	20¢	-	-	-
S5	S6	S7	S9	S10	S5	S5	S5	-	-	-	25¢	-	-	-
S6	S7	S8	S10	S10	S6	S6	S6	-	-	-	30¢	-	-	-
S7	S8	S9	S10	S10	S7	S7	S7	-	-	5¢	35¢	-	-	-
S8	S9	S10	S10	S10	S8	S8	S8	-	-	10¢	40¢	-	-	-
S9	S10	S10	S10	S10	S9	S9	S9	-	5¢	15¢	45¢	-	-	-
S10	S10	S10	S10	S10	S0	S0	S0	5¢	10¢	20¢	50¢	100plus	Apple Juice	Orange Juice



Question 4

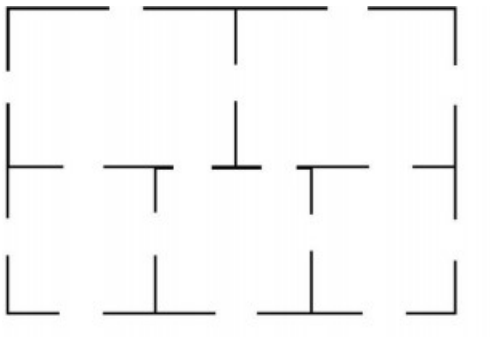
Construct a finite-state machine and state table that models a newspaper vending machine that has a door that can be opened only after either three dimes (and any number of other coins) or a quarter and a nickel (and any number of other coins) have been inserted. Once the door can be opened, the customer opens it and takes a paper, closing the door. No change is ever returned no matter how much extra money has been inserted. The next customer starts with no credit.

States	Nickel (5¢)	Dime (10¢)	Quarter (25¢)	Nickel (5¢)	Dime (10¢)	Quarter (25¢)
S0	S3	S1	S8	-	-	-
S1	S4	S2	S7	-	-	-
S2	S5	S0	S6	-	Newspaper	-
S3	S3	S4	S0	Newspaper	-	-
S4	S0	S5	S4	Newspaper	-	-
S5	S0	S0	S5	Newspaper	Newspaper	-
S6	S6	S0	S0	-	Newspaper	Newspaper
S7	S7	S6	S0	-	-	Newspaper
S8	S8	S7	S0	-	-	Newspaper

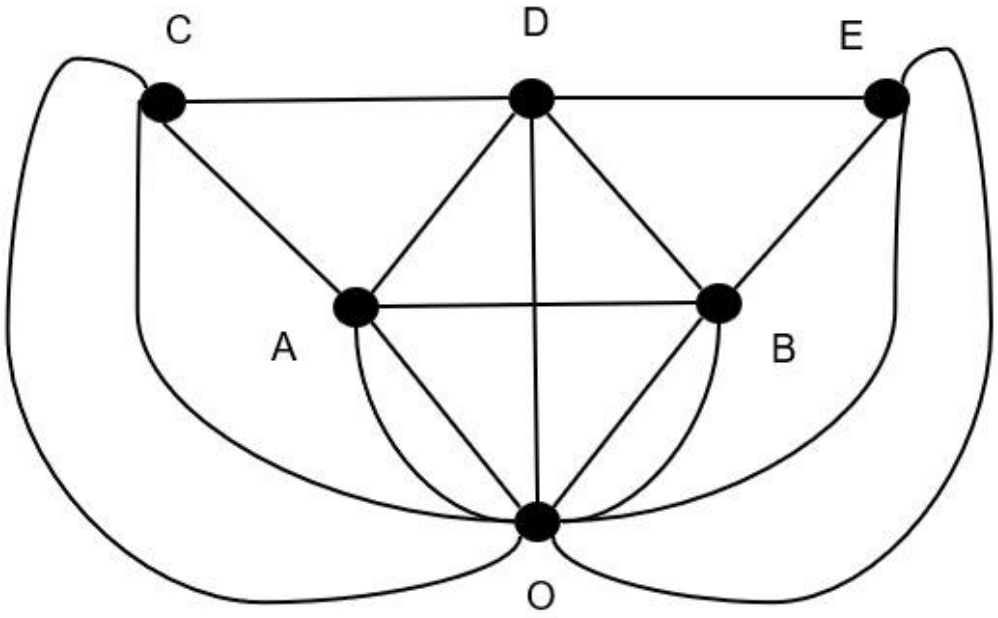


Question 5

Consider the following five room apartment.



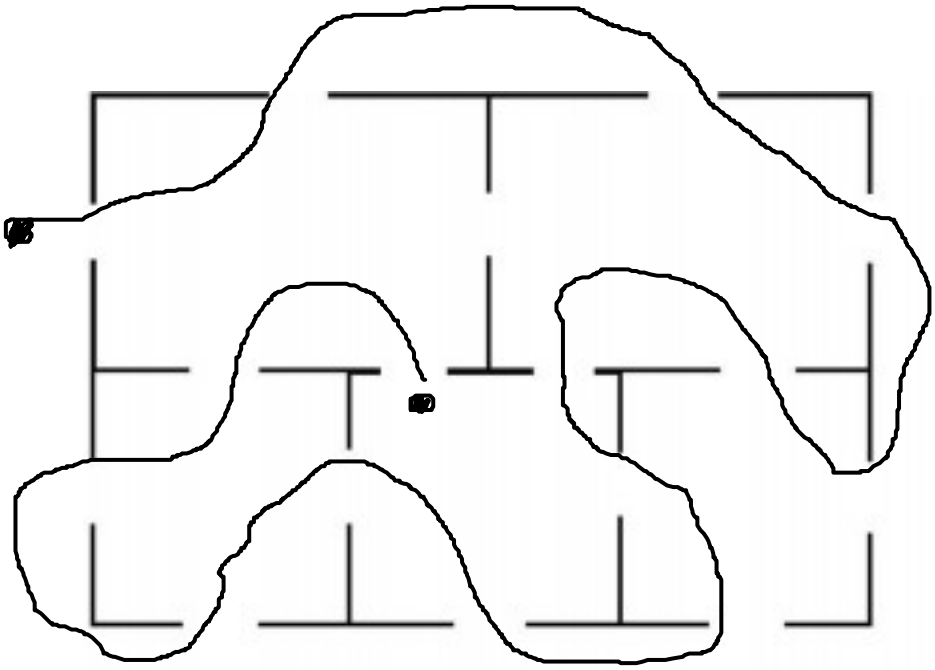
a) If we make this floor plan into a graph, what does it look like?



b) Can you find a continuous line that pass through each door exactly once? If yes, draw it. If no, explain why not.

No continuous line. Because room A,B and D have an odd number of doors. Thus, there is no Euler circuit.

c) Now we are allowed to close doors of the apartment. After closing at least how many doors we can find a continuous line that passes through each door exactly once? Draw it.



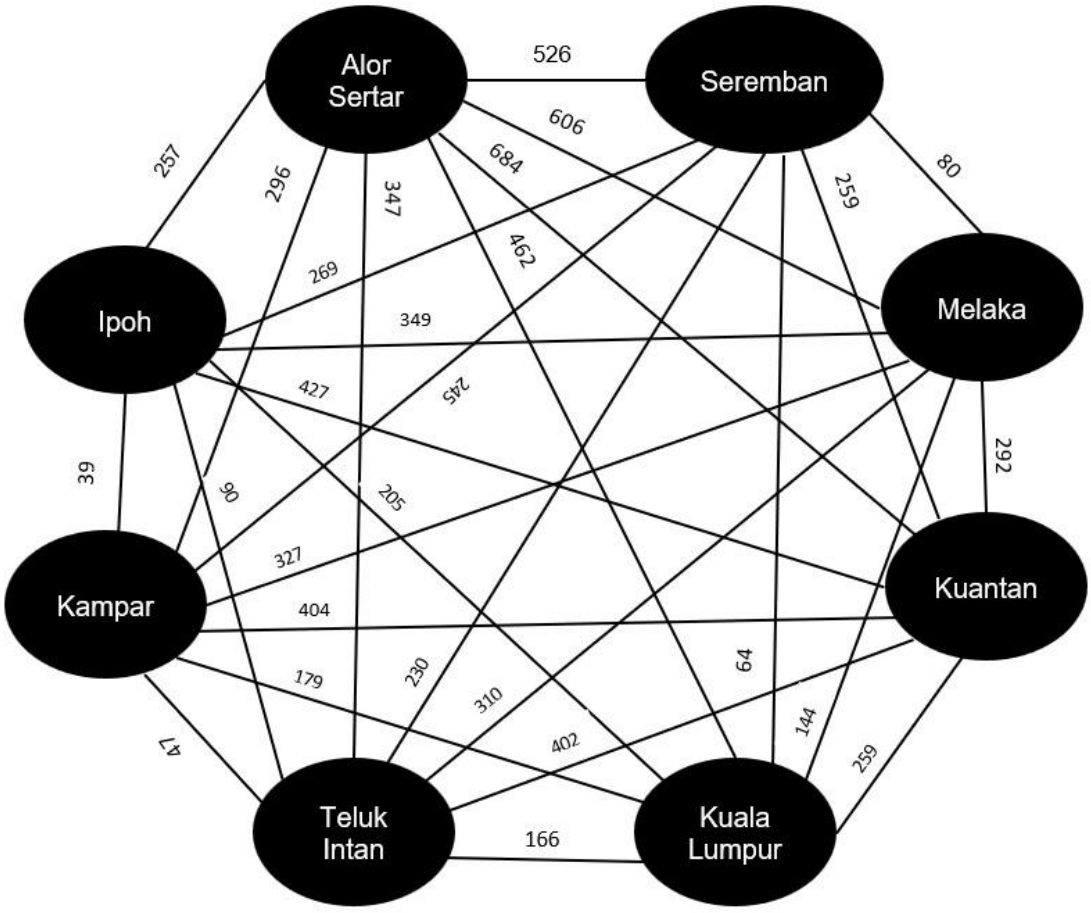
Close at least one door to get continuous line.

Question 6

The distances between eight cities are given in the following table.

	Alor Setar	Ipoh	Kampar	Teluk Intan	Kuala Lumpur	Kuantan	Melaka	Seremban
Alor Setar		257	296	347	462	684	606	526
Ipoh	257		39	90	205	427	349	269
Kampar	296	39		47	179	404	327	245
Teluk Intan	347	90	47		166	402	310	230
Kuala Lumpur	462	205	179	166		259	144	64
Kuantan	684	427	404	402	259		292	259
Melaka	606	349	327	310	144	292		80
Seremban	526	269	245	230	64	259	80	

a) Draw the graph of all the cities above.



b) Use Kruskal's algorithm to find a minimal spanning tree whose vertices are these cities. What is the total distance for the tree?

(Ipoh, Kampar) : 39

(Kampar, Teluk Intan) : 47

(Kuala Lumpur, Seremban) : 64

(Melaka, Seremban) : 80

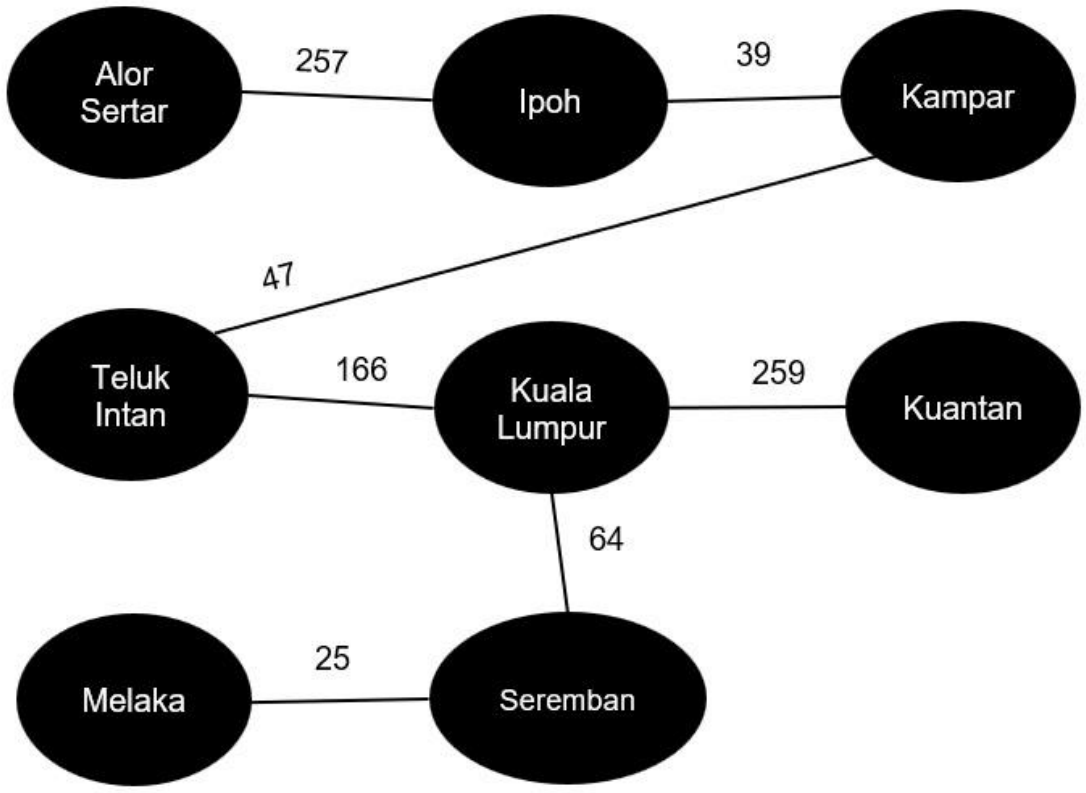
(Kuala Lumpur, Teluk Intan) : 166

(Ipoh, Alor Setar) : 257

(Kuantan, Kuala Lumpur) : 259

Total =39 + 47 + 64 + 80 + 166 + 257 + 259

=912



c) Find the minimal spanning tree using Prim's Algorithm. What is the total distance for the tree?

(Melaka, Seremban) : 80

(Seremban, Kuala Lumpur) : 64

(Kuala Lumpur, Teluk Intan) : 166

(Teluk Intan, Kampar) : 47

(Kampar, Ipoh) : 39

(Ipoh, Alor Setar) : 257

(Kuantan, Kuala Lumpur) : 259

Total =80 + 64 + 166 + 47 + 39 + 257 + 259 = 912

=912