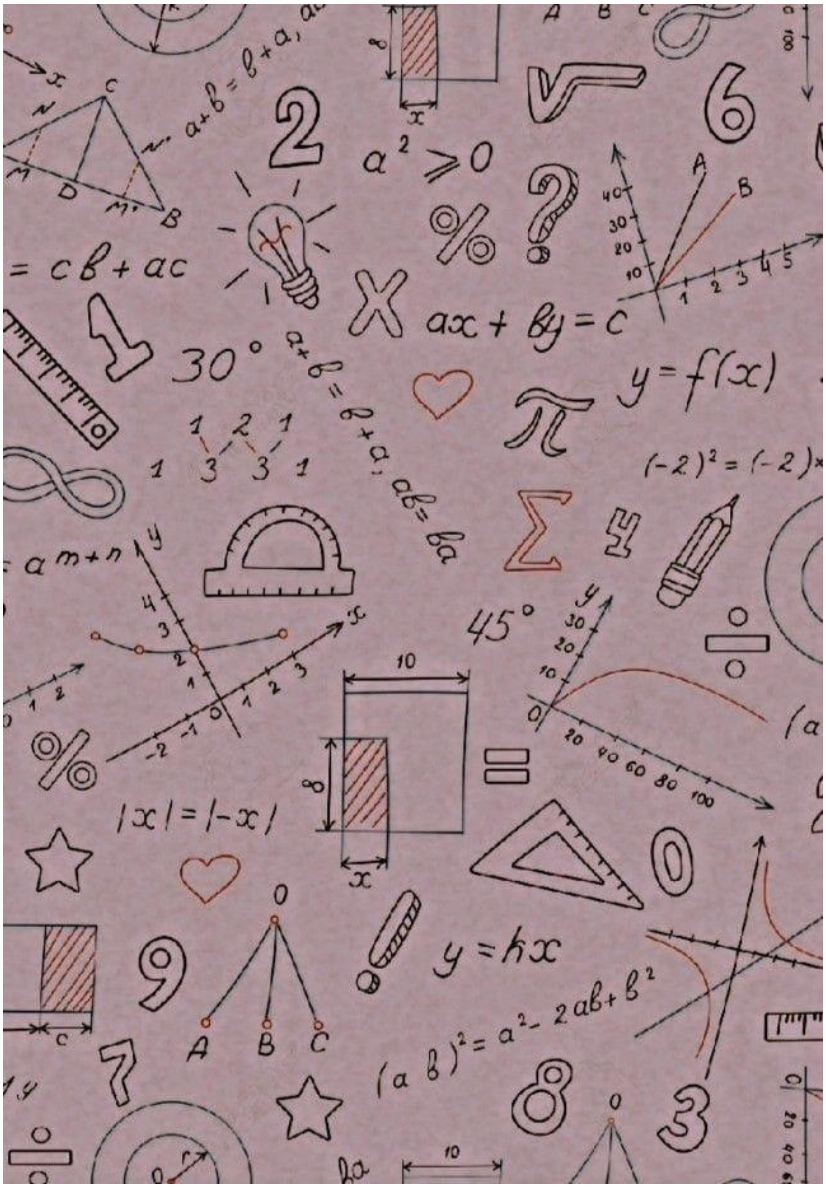
22nd July 2022

UNIVERSITY OF MAURITIUS

DISCRETE STRUCTURES – 1042Y

ASSIGNMENT 2



ID: 2117144

Name: Deesha Beerachee

Submitted to: Mr Oomesh Gukhool

Question 1

FSM 1: An elevator system

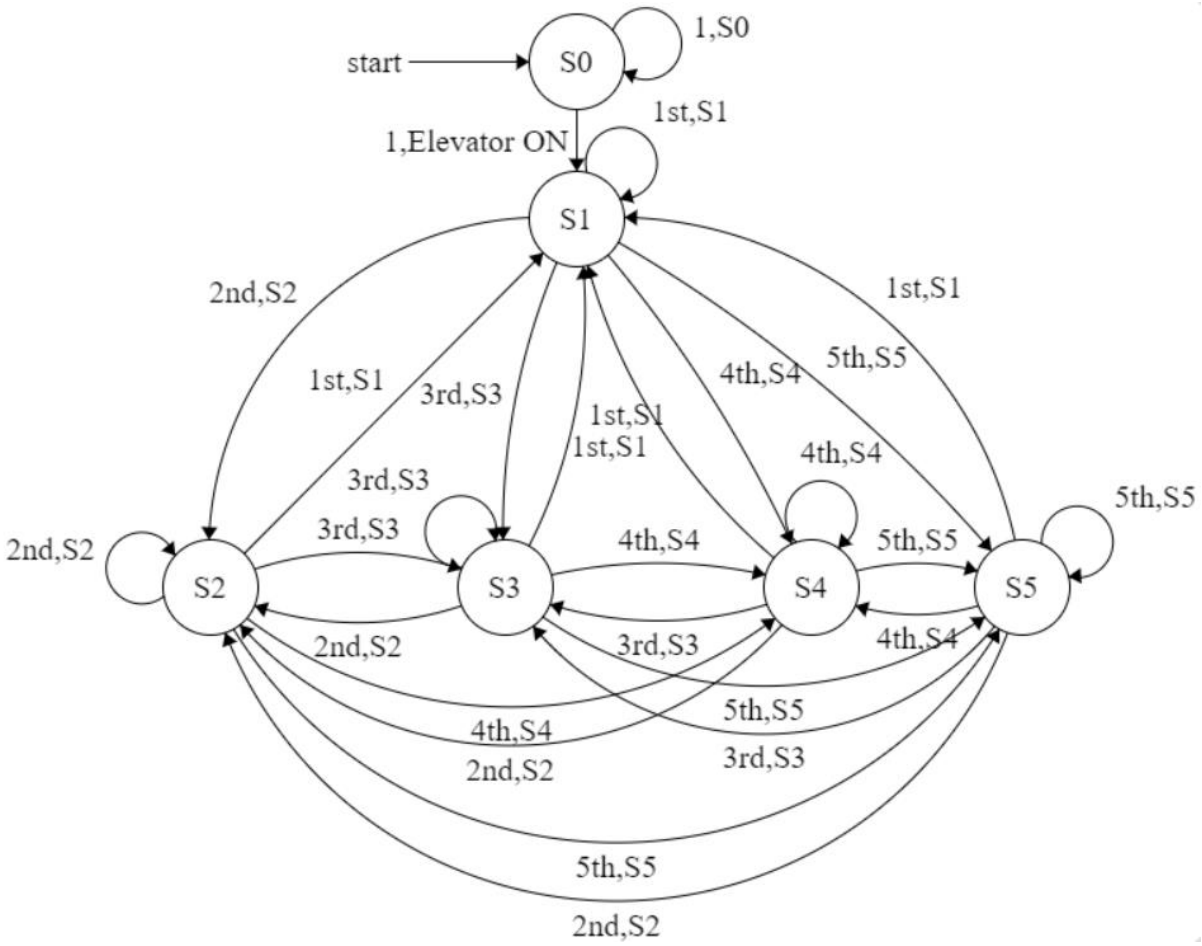
This is a system built for any 5 level building. First off, there is a security to turn on the button S0 to activate the elevator. Once this is done, the elevator will start accepting input. Initially, the elevator is set at 1st floor, depicted by S1. There is now 5 buttons, one for each floor, labelled 1st, 2nd, 3rd, 4th and 5th respectively. Upon entering 1st floor, the user will stay at this floor and nothing will happen (no output), whereas when pressing any subsequent button, it moves them to that particular floor. Similarly, this applies for the 2nd, 3rd, 4th and 5th button.

State table:

		f		**g**				
State	**State Name**	**0**	**1**	**1st**	**2nd**	**3rd**	**4th**	**5th**
S0	Elevator's key switch / ON Switch	S0: Elevator is Locked / Not in Use	S1: Elevator is Unlocked / In Use	-	-	-	-	-
S1	First Floor	-	-	S1: Remain at 1st Floor	S2: Move to 2nd Floor	S3: Move to 3rd Floor	S4: Move to 4th Floor	S5: Move to 5th Floor
S2	Second Floor	-	-	S1: Move to 1st Floor	S2: Remain at 2nd Floor	S3: Move to 3rd Floor	S4: Move to 4th Floor	S5: Move to 5th Floor
S3	Third Floor	-	-	S1: Move to 1st Floor	S2: Move to 2nd Floor	S3: Remain at 3rd Floor	S4: Move to 4th Floor	S5: Move to 5th Floor
S4	Fourth Floor	-	-	S1: Move to 1st Floor	S2: Move to 2nd Floor	S3: Move to 3rd Floor	S4: Remain at 4th Floor	S5: Move to 5th Floor

S5	**Fifth floor**	-	-	S1: Move to 1st Floor	S2: Move to 2nd Floor	S3: Move to 3rd Floor	S4: Move to 4th Floor	S5: Remain at 5th Floor

State diagram:



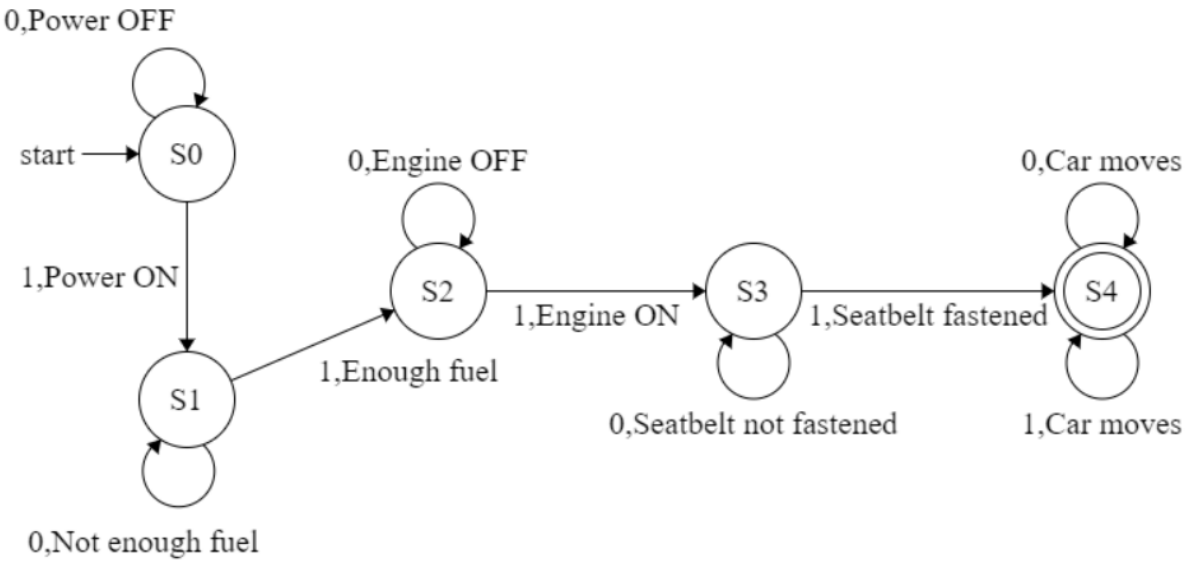
FSM 2: Fasten seat belt system

This is a seat belt fastening system for any automobiles. The system will prompt the user to buckle up his/her seat belt as this is done to ensure the security of a driver. First of all, it starts with the initial state, S0, which is responsible to start the car by powering ON. If the power is OFF, it will continue to accept input and upon taking required power, it will evaluate the fuel, S1. If there is enough fuel, the user will be taken to s2 state otherwise it will prompt the user to enter enough fuel. At S2 if the engine has already started, the user will be taken to S3 where he/she needs to fasten his/her seat belt, or else it will be kept there until it is fastened. Following this, it will be instructed to enter the state of the car that is ready for movement commands. And in this final state S4, the vehicle will proceed in accordance with the driver's directions.

State table:

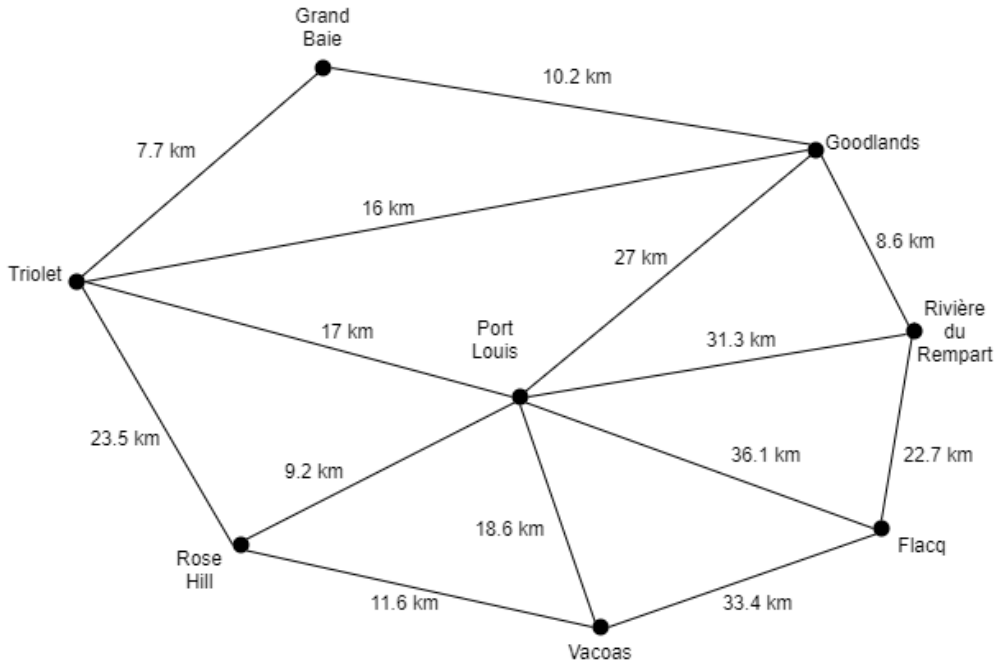
		f	
States	**State Name**	**0**	**1**
S0	Power evaluation state	S0: Power OFF	S1: Power ON
S1	Fuel evaluation state	S1: Not enough Fuel	S2: Enough fuel
S2	Engine evaluation state	S2: Engine not started	S3: Engine started
S3	Seat belt State	S3: Seat belt for fastened	S4: Seat belt fastened
S4	Car motion state	S4: Car moves	S4: Car moves

State diagram:



Question 2

8 villages/towns chosen: Grand Baie, Triolet, Rose Hill, Port Louis, Vacoas, Flacq, Rivière du Rempart, Goodlands



(a)

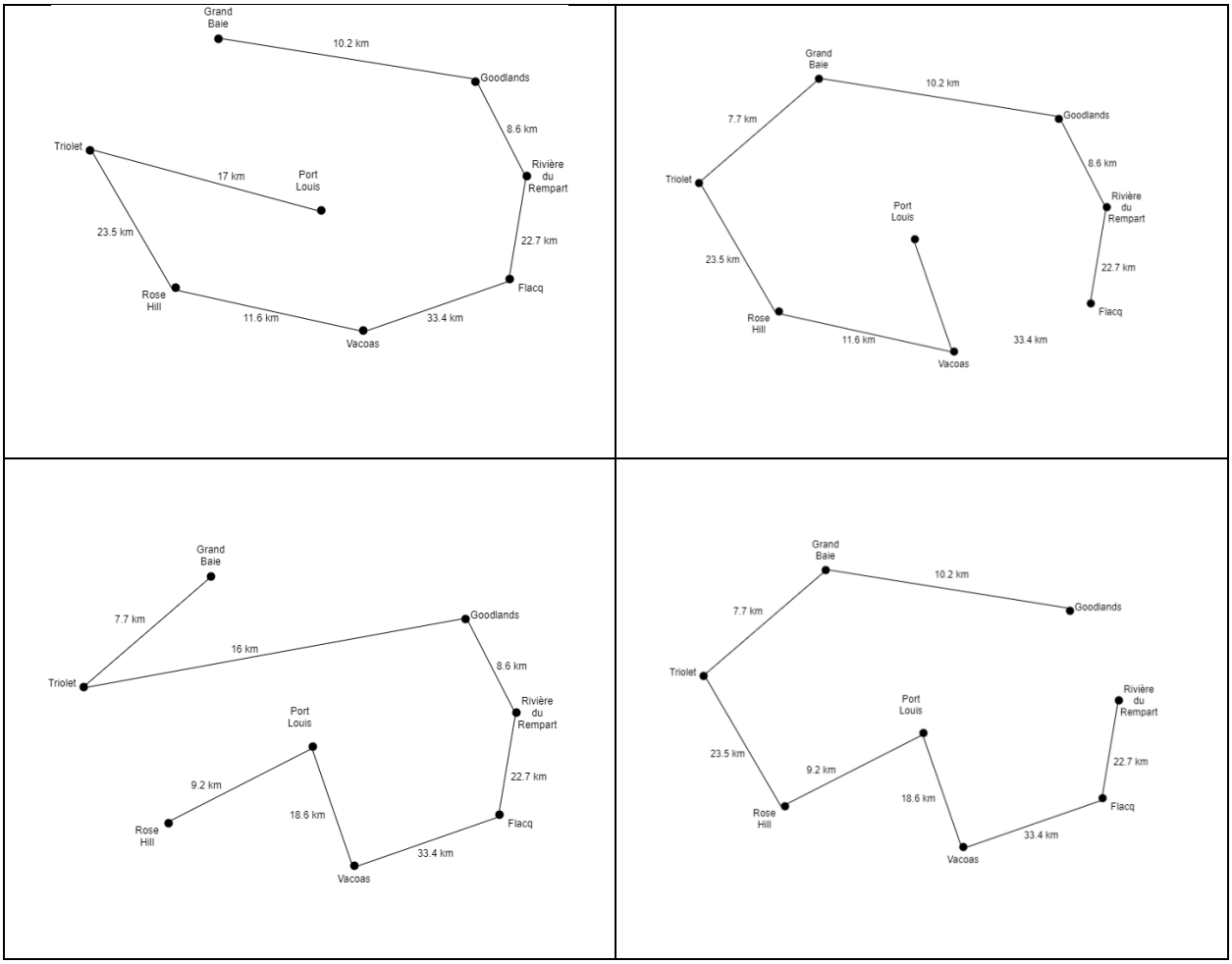
There is a Hamilton path since all vertex are visited exactly once.

Hamilton path: Port Louis, Triolet, Rose Hill, Vacoas, Flacq, Rivière du Rempart, Goodlands, Grand Baie

The graph has a Hamilton circuit since each vertex are visited exactly once before reaching the starting vertex.

(b)

Spanning trees:



Maximum number of spanning trees = $n^{(n-2)}$

$= 8^{(8-2)}$

$=8^6$

= 262, 144

(c)

Vertex	**Shortest distance from Grand Baie**	**Previous vertex**
Grand Baie	0	
Triolet	∞ |7.7	Grand Baie
Rose Hill	∞ |31.3	~~Triolet~~ | Port Louis
Port Louis	∞ |24.7	~~Triolet~~ | Rivière du Rempart
Vacoas	∞ |43.3	Port Louis
Flacq	∞ |41.5	Rivière du Rempart
Rivière du Rempart	∞ |18.8	Goodlands
Goodlands	∞ |10.2	~~Grand Baie~~ | Triolet

Visited nodes: Grand Baie, Triolet, Goodlands, Rivière du Rempart, Port Louis, Rose Hill, Vacoas

Shortest path between Vacoas to Grand Baie = 43.3 km

Path: Vacoas→Port Louis→Riviere du Rempart→Goodlands→Triolet→Grand Baie

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