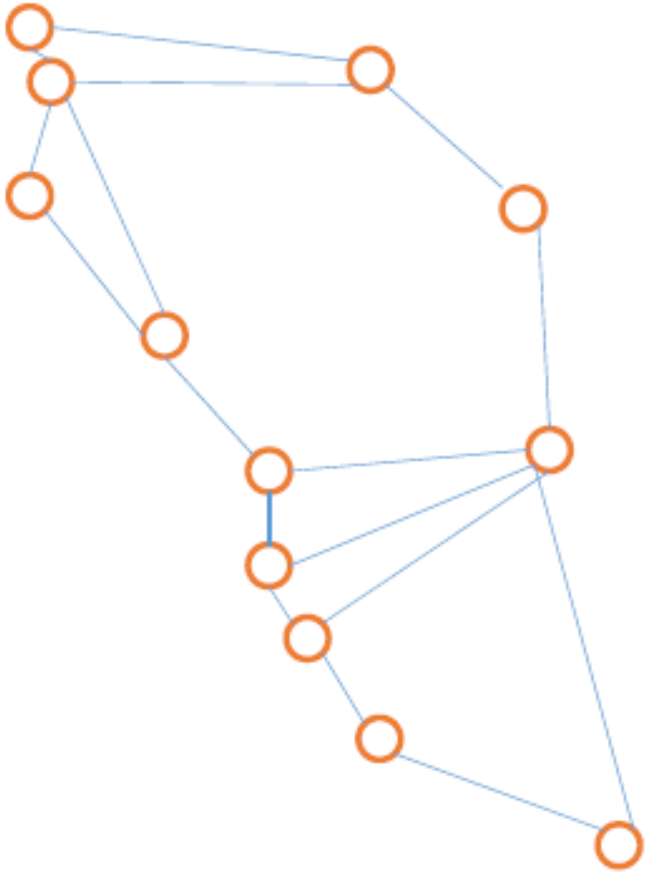
Part 1
Graph Applications
Data Structure: Graph

Shortest Path Problem

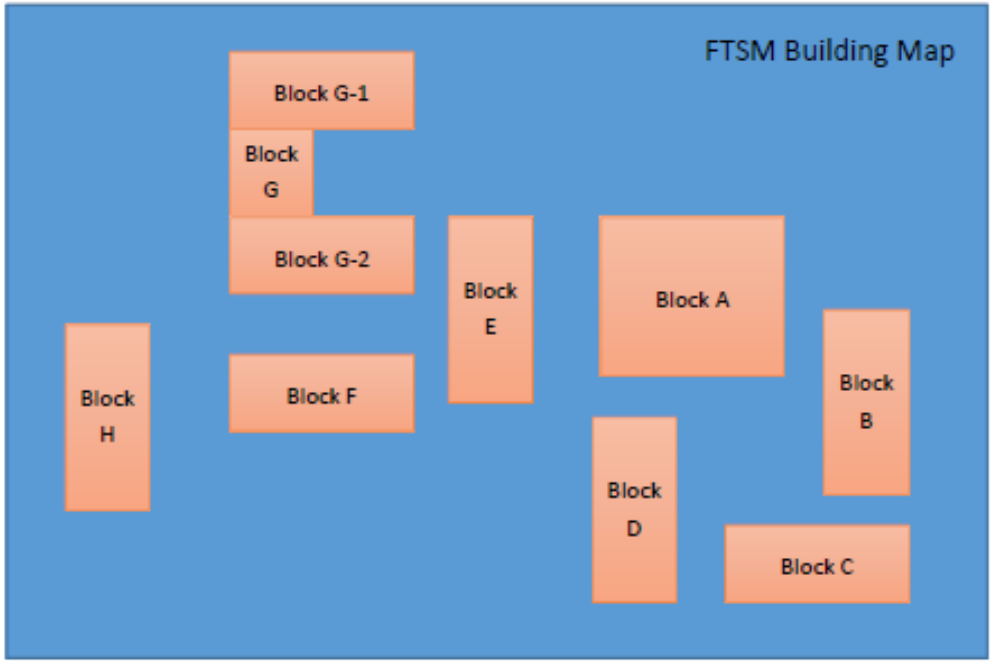
Finding the shortest/cheapest path for a car from one city to another, by using given roads.

Case study: City in Malaysia



Minimum Spanning Tree Problem

Telekom Malaysia offers a high speed broadband service, UniFi, to FTSM. All blocks in FTSM will be connected with fiber optics, which cost RM20 for 1 meter.
Find the cheapest way to connect all blocks in FTSM.

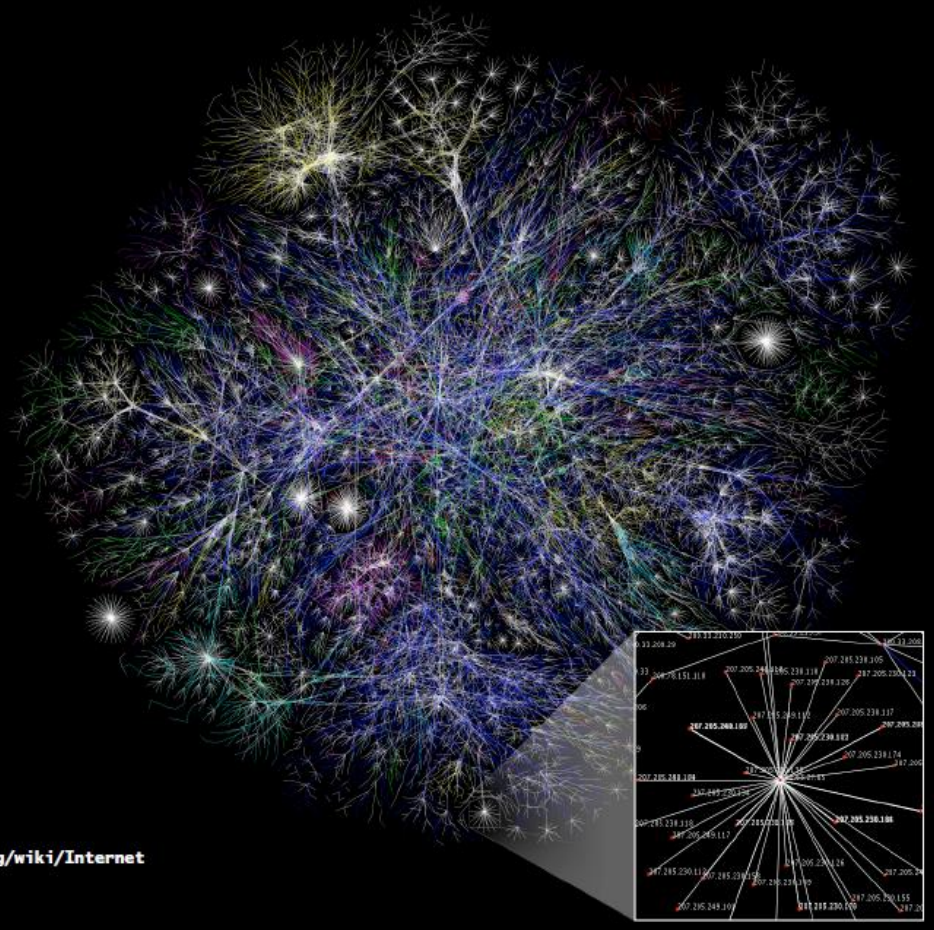


Travelling Salesman Problem

A postman has to visit a set of streets at housing area in Section 8, Bandar Baru Bangi, in order to deliver mails and packages. It is needed to find a path that starts and ends at the post-offic, and that passes through each street (edge) exactly once. Assume that the post office is near to Surau Al-Amin.

This way the postman will deliver mails and packages to all streets he has to, and in the same time will spend minimum efforts/time for the road.

The Internet as mapped by the Opte Project



http://en.wikipedia.org/wiki/Internet

10 million Facebook friends

"Visualizing Friendships" by Paul Butler

More Graph Applications

graph	vertices	edges
communication	telephones, computers	fiber optic cables
circuits	gates, registers, processors	wires
mechanical	joints	rods, beams, springs
hydraulic	reservoirs, pumping stations	pipelines
financial	stocks, currency	transactions
transportation	street intersections, airports	highways, airway routes
scheduling	tasks	precedence constraints
software systems	functions	function calls
internet	web pages	hyperlinks
games	board positions	legal moves
social relationship	people, actors	friendships, movie casts
neural networks	neurons	synapses
protein networks	proteins	protein-protein interactions
chemical compounds	molecules	bonds

More Graph Applications

graph
communication
circuits
mechanical
hydraulic
financial
transportation
scheduling
software systems
internet
games
social relationship
neural networks
protein networks
chemical compounds

What is graph?

- In mathematics and computer science, graph theory is the study of graphs, which are mathematical structures used **to model pairwise relations between objects.**

Why study graph?

- Thousands of practical applications.
- Hundreds of graph algorithms known.
- Interesting and broadly useful abstraction.
- Challenging branch of computer science and discrete math

Important Terms

- Edges
- Vertices/Nodes
- Un/directed graph
- Un/weighted graph
- Dis/connected Graph
- Path, Cycle

Refer to your TR1313 Mathematics 1 notes