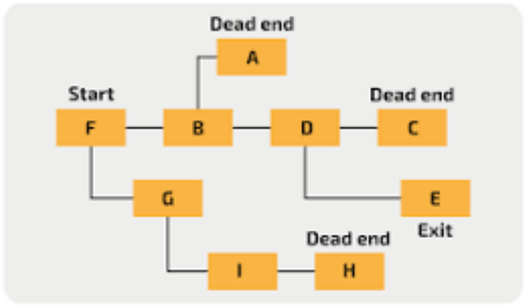
Problem Solving Strategies

Backtracking

- Uses algorithms, often recursively.
- Builds a solution methodically.
- Based on paths which have been visited and found to be correct.
- The algorithm backtracks to the previous stage if an invalid path is found.

Best described as an "**Organised Brute Force**"

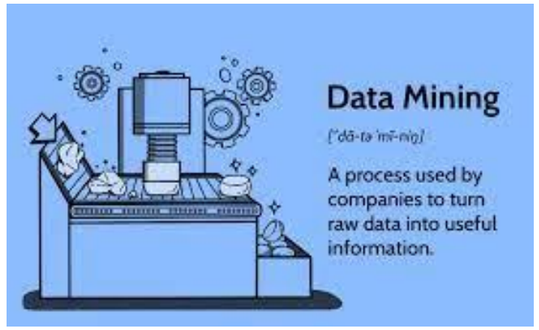


Performance Modelling

- Mathematical method to test loads on systems.
- A cheaper and less time consuming method of testing applications.
- Used for safety critical systems where a trial run can't be carried out.

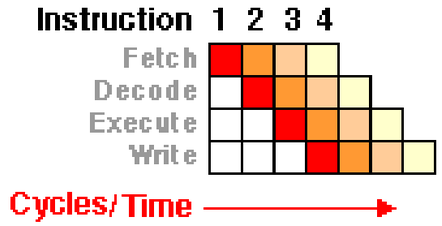
Data Mining

- Analysing/converting large quantities of data into useful information
- To find patterns / trends / anomalies in data
- To find information / relationships /facts not obvious to the user
- These data sets are known as "big data".
- It spots correlations between data and other trends which might not be easy to see.
- Can be used to make predictions about the future.
- A useful tool to assist in business and marketing.



Pipelining

- The division of instructions into a series of steps
- A different part of each series of steps for a different instruction can be run by the processor at the same time
- An instruction can be fetched whilst another is decoded whilst another is executed.
- use of pipelining will make more efficient use of processor **because** it reduces/removes latency and the CPU is not idle while waiting for next instruction.
- Next instruction is fetched while current one is decoded/executed **therefore** more instructions executed per second
- Pipelining efficiency reliant on programs (mostly) executing sequentially (efficiency reduced by jump instructions requiring pipeline to be reset)

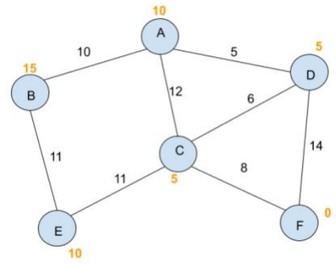


Heuristics

- A rule-of-thumb approach that provides an estimate.
- Used to find an approximate solution to a problem.
- Used when the exact/standard solution would take too long.
- Does not guarantee a 100% accurate or optimal solution, but reduces the time needed to solve the problem.

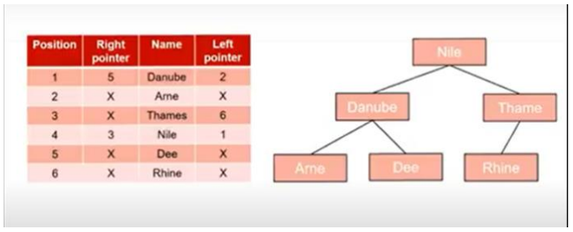
For example: A* shortest path

- Heuristic is an estimated cost of each distance
- Heuristic is added to distance to identify least cost next step
- It does not revisit routes already visited
- It does not visit every single possibility…
- ...as it focuses on nodes that are promising
- It ignores some areas to speed up finding a solution



Visualisation

- It is a graphical representation, for example presenting data using graphs.
- Often using objects and symbols
- Used to simplify the problem
- Makes it easier for humans to understand.



Position	Right pointer	Name	Left pointer
1	5	Danube	2
2	X	Ame	X
3	X	Thames	6
4	3	Nile	1
5	X	Dee	X
6	X	Rhine	X