interaction between a human and a website.

vii) A statistical measure used in artificial neural networks to calculate error gradients so that actual neuron weightings can be adjusted to improve the performance of the model.

viii) A statistical measure used to make predictions from data by finding learning relationships between input and output values.

ix) Data where we know the target answer and data objects are fully recognised and identified.

x) Improvements made to a model based on negative and positive feedback: actions are optimised to increase the amount of positive feedback.

End of chapter questions

1 a) Answer these multiple choice questions.

i) Identify the statement that best describes *artificial intelligence*.

[1]

A putting human intelligence into a computer system
B programming a computer using a user's intelligence
C making a machine intelligent
D playing a game on a computer
E adding more memory units to a computer

ii) Identify the programming language that is **not** used when programming AI systems.

[1]

A Java
B JavaScript
C Lisp
D Perl
E Prolog

iii) Identify the correct description of a heuristic approach.

[1]

A trying to improve algorithms using back propagation
B searching and measuring how far away a node is from its destination
C comparison of two nodes in a graph to see which is nearer to the destination node
D an informed 'guess' about which node will lead to the required goal
E all the above

b) Copy the diagram below and connect each description to either machine learning or deep learning.

[8]

Learning type	Description
	needs only a small amount of training data
	problems are solved in an end to end manner
Deep learning	enables machines to make decisions with the help of artificial neural networks
	has clear rules to explain how decisions were made
Machine learning	makes use of modular approach at design and training stages
	needs vast amounts of data during training and development
	enables machines to make decisions on their own based on past data
	makes decisions based on its own logic so the reasoning may be difficult to interpret

2 a) Describe **three** features you would associate with:

i) reinforcement learning

[3]

ii) supervised learning.

[3]

b) Explain why these applications are regarded as artificial intelligence.

i) Chat bots

[2]

ii) Search engines

[2]

iii) Photographic enhancement applications

[2]

3 Copy and complete the text, using words from the box. Words may be used once, more than once, or not at all.

[10]

actual output	machine learning	reinforcement learning
back propagation	minimised	removed
deep learning	random weighting	static
error gradients	recurrent	supervised learning
expected results	regression	testing

When designing artificial neural networks, each neuron is given a .....

The ..... is compared to the ..... as part of the training.

..... are used to update the neural weightings.

Weightings are updated until the errors are ..... or are .....

This process is known as .....

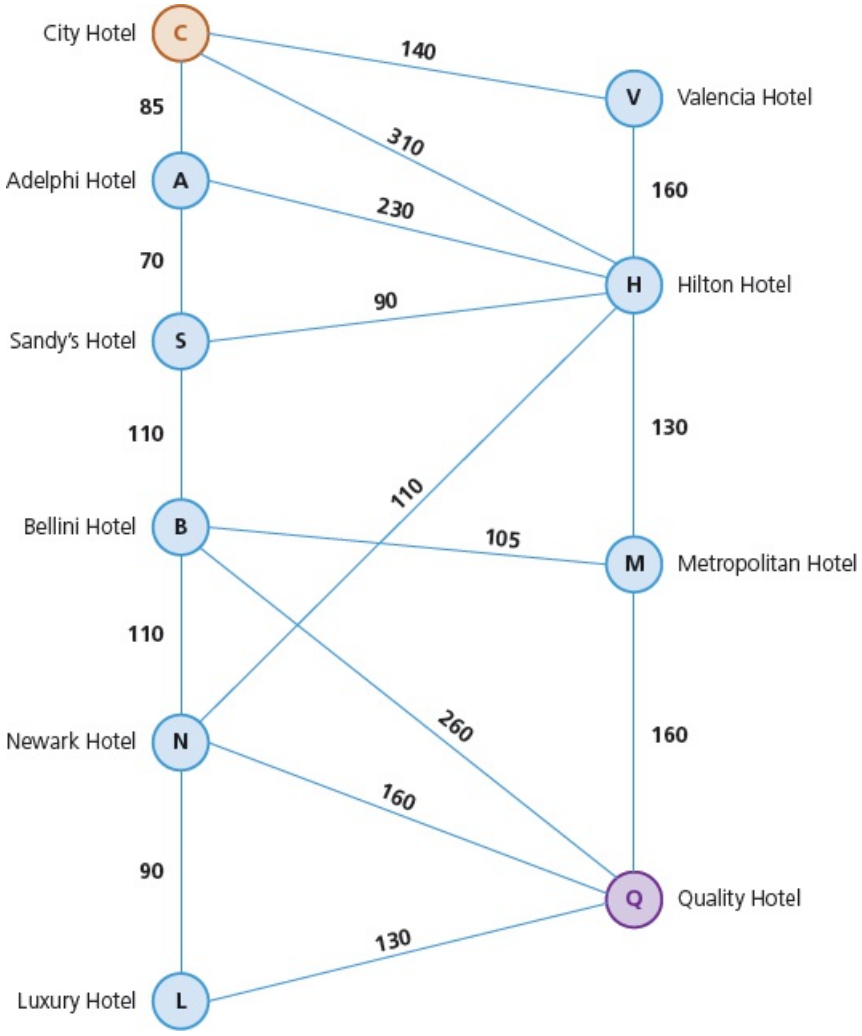
There are two types: ..... and .....

Machine learning uses ..... to make predictions from data by looking at learning relationships.

4 a) Explain the difference between the A* algorithm and Dijkstra's algorithm.

[2]

b) The following graph (network) shows how long it takes (in seconds) to walk between ten hotels in a city.



i) Using Dijkstra's algorithm, show the shortest time to walk from the City Hotel (C) to the Quality Hotel (Q).

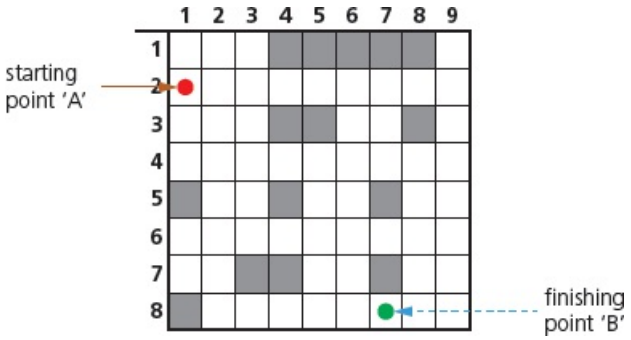
[8]

ii) Give the route corresponding to your answer in part b)i).

[1]

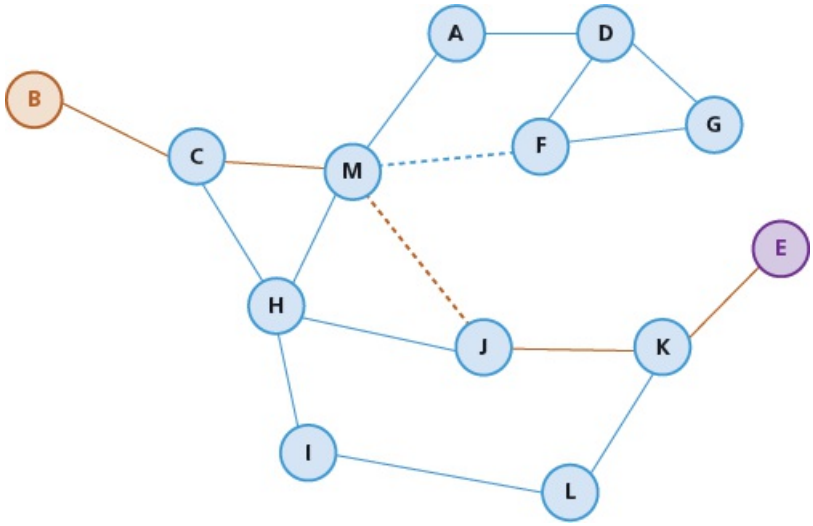
5 The following graph is made up of a (9 × 8) matrix.
Use the A* algorithm to show the shortest route from A to B.

[8]

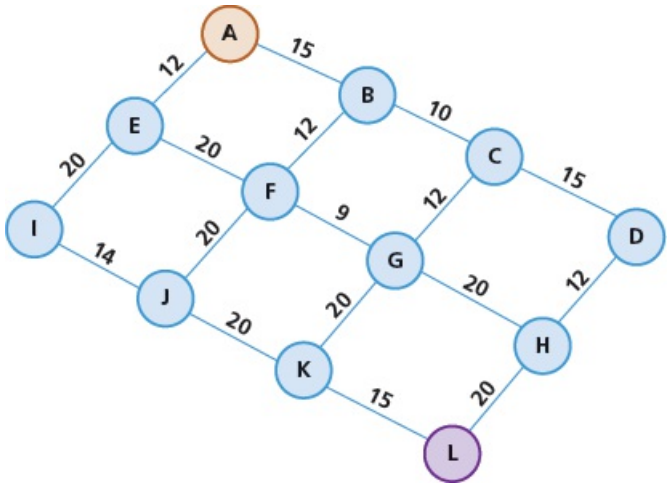


6 Tom is using a GPS device to navigate from point B to point E.
Tom's GPS uses the A* algorithm to find the shortest route:
B → C → M → J → K → E
This route is shown in orange on the diagram.
However, due to some major flooding, routes M to J and M to F have been closed, making the original path no longer possible.
Describe how the GPS system will use the A* algorithm to find an alternative route from B to E.

[4]



7 The following graph shows the routes connecting buildings on a university campus. The numbers represent the time taken (in minutes) to cycle from one building to another.



a) i) Use Dijkstra's algorithm to find the minimum time to cycle from building A to building L.

[8]

ii) Write down the corresponding shortest route.

[1]

b) It has been decided to construct a new cycle path, either from A directly to D (cycle time

30 minutes) or from A directly to I (cycle time 20 minutes).
Identify the option that would reduce the cycle time from building A to building L by the greatest amount.

[4]