



THE UNIVERSITY OF THE WEST INDIES

Semester I ☒ Semester II ☐ Supplemental/Summer School ☐

Examinations of December ☒ /April/May ☐ /July ☐ 2017

Originating Campus: Cave Hill ☐ Mona ☒ St. Augustine ☐

Mode: On Campus ☒ By Distance ☐

Course Code and Title: COMP3220 – Principles of Artificial Intelligence

Date: 19th December 2017

Time: 9:00-11:00 a.m.

Duration: 2 hours

Paper No:

Materials required:

Answer booklet: Normal ☒ Special ☐ Not required ☐

Calculator: Programmable ☐ Non Programmable ☐
(where applicable)

Multiple Choice answer sheets: numerical ☐ alphabetical ☐ 1-20 ☐ 1-100 ☐

Auxiliary/Other material(s) – Please specify:

Candidates are permitted to bring the following items to their desks:

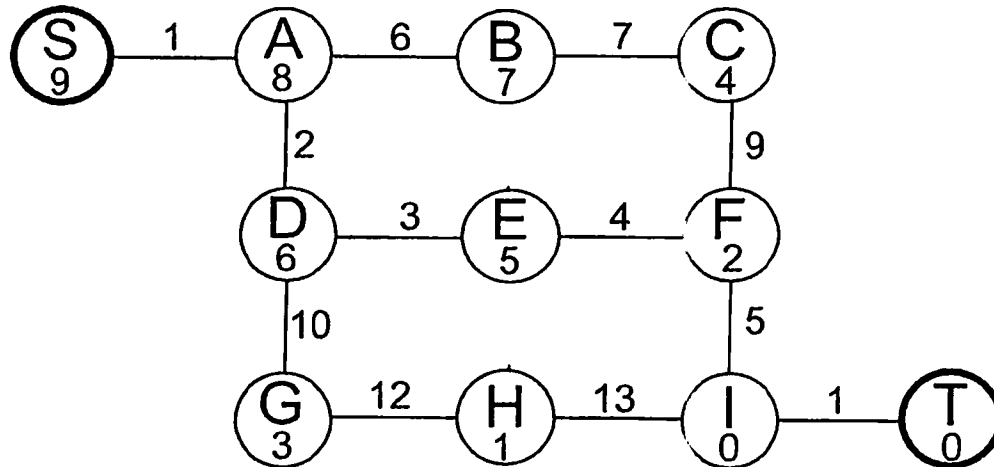
Instructions to Candidates: This paper has 6 pages & 4 questions.

Answer any three (3) questions.

Candidates are reminded that the examiners shall take into account the proper use of the English Language in determining the mark for each response.

Question 1**[20 marks]**

- a) The definitions of AI fall under four categories. List the categories and identify where the Turing test falls. Justify your choice. **[6 marks]**
- b) The wumpus world is a cave consisting of rooms connected by passageways. Lurking somewhere in the cave is the wumpus, a beast that eats anyone who enters its room. The rooms adjacent to wumpus have a stench. The wumpus can be shot by an agent, but the agent has only one arrow. Some rooms contain bottomless pits that will trap anyone who wanders into these rooms (except for the wumpus, which is too big to fall in). The only mitigating feature of living in this environment is the possibility of finding a heap of gold which is seen by the glitter in the cell.
- i. Suppose you are asked to design an intelligent agent to find gold in the wumpus world, develop the PEAS description for this task (P: Performance, E: Environment, A: Actuators and S: Sensors). **[5 marks]**
 - ii. Characterize the environment according to the properties discussed in class (i.e. observable, deterministic, episodic). Give reasons for your choice. **[6 marks]**
 - iii. Select and describe an agent architecture design that would be most suitable for this domain (i.e. simplex reflex agent, model based agent or goal based agent). Give reasons for your choice. **[3 marks]**

Question 2**[20 marks]**

In the given graph, S is the initial state, T is the goal state and the numbers on the edges are costs to travel those paths and the heuristic costs are given in the nodes.

- a) Draw the state space to search for path between S and T, if more than one path can be explored at a time in the graph then select the node with the label that comes earlier in the alphabet (i.e. A will be selected before B).

[5 marks]

- b) Using each of the Breadth First Search, Best-First Search and Uniform Cost Search and work out a route from state S to T. In your answer provide the order in which the nodes were expanded and state the route that will be taken.

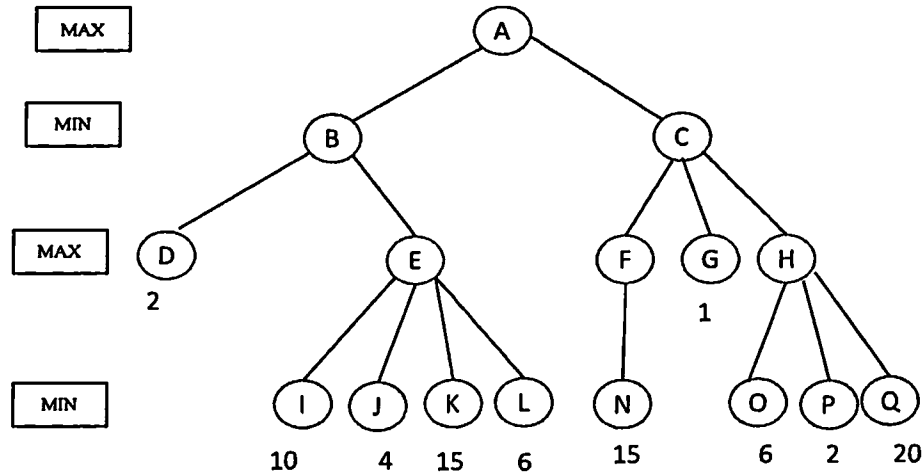
[9 marks]

- c) Compare and Contrast the search techniques in part (b) in terms of time and space complexity and optimality.

[6 marks]

Question 3**[20 marks]**

The game tree below depicts the game state between two players in which the first player is trying to maximize their value.



a) Use the minimax algorithm to indicate the values at the following nodes.

- i.) E
- ii.) B
- iii.) C
- iv.) A

[4 marks]

b) Using alpha beta pruning determine which nodes will be pruned without affecting the outcome. Show alpha beta values on the game tree.

[6 marks]

c) Given the following dataset what type of machine learning algorithms would you select to determine the features of characters who are *killable with jump*, justify your answer.

[4 marks]

ID	Character	Enemy	Talks	Boss	Annoying	Killable with Jump
A	Yoshi	N	N	N	N	N
B	Tree	N	N	N	N	N
C	Luigi	N	N	N	N	N
D	Toad	N	Y	N	N	N
E	Peach	N	Y	N	Y	N
F	Bowser	Y	N	Y	N	N
G	Bob-omb	Y	N	N	N	Y
H	Goomba	Y	N	N	N	Y
I	Piranha	Y	N	N	Y	N
J	Dry Bones	Y	N	N	Y	N
K	Chain Chomp	Y	N	N	Y	N

d) Given the following prolog code.

```
father (andy, ben) .
```

```
father (andy, carl) .
```

```
father (ben, dave) .
```

```
father (ben, ed) .
```

```
descendent (X, Y) :- father (X, Y) .
```

```
descendent (X, Y) :- father (X, Z) , descendent (Z, Y) .
```

i.) What would be the result of the following query?

```
?- descendent (andy, ed) .
```

[1 marks]

ii.) Draw the and/or search tree for this query.

[4 marks]

Question 4**[20 marks]**

- a) Choose a sub-area of AI that you or your colleagues researched during the term. Briefly describe this area. Identify an application in Jamaica that you think could benefit from the use of techniques related to this area. Use example(s) to support your points.

[8 marks]

- b) If someone has an allergy they sneeze. If there is a cat and there is a person who is allergic to cats then they will have allergies. There is a cat, also Jane is allergic to cats.

Use the following predicates in your representation, *cat*, *allergy*, *sneeze*, *allergictocat*. Represent the information above in logic. Prove using resolution theorem prover that Jane will sneeze.

[6 marks]

- c) Given the following rules and facts, explain how forward chaining and backward chaining would attempt to determine who is transformed to a porcupine.

RULES:

R0: IF nerd(?X)
THEN muggle(?X) and consumedbutterbeer(?X)

R1: IF mathsjokes(?X)
AND consumedbutterbeer(?X)
THEN transformed_porcupine(?X)

R2: IF fancies(?X,?Y)
AND fancies(?Y,?X)
AND muggle(?Y)

THEN kiss(?X,?Y)

R3: IF mathsjokes(?X)
AND fancies(?X,?Y)
THEN fancies(?Y,?X)

R4: IF mathsjokes(?X)
THEN nerd(?X)

FACTS:

mathsjokes(David)
consumedbutterbeer(Jackie)
fancies(David, Jackie)

[6 marks]**END OF QUESTION PAPER**