UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	ARTIFICAL INTELLIGENCE
COURSE CODE	:	BEC 41503
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONORS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. WRITE **ALL** ANSWERS USING BLUE / BLACK INK PEN. ANY ANSWERS WRITTEN IN PENCIL WILL NOT BE GRADED 3. ANSWER MUST BE WRITTEN IN THIS QUESTION **BOOKLET**

THIS QUESTION PAPER CONSISTS OF **THIRTEEN (13)** PAGES

SECTION A

Q1   Which event is considered the "birth" of the field of Artificial Intelligence?

    A. The formulation of the Turing test by Alan Turing in 1950
    B. A workshop in the summer of 1956 at Dartmouth
    C. The development of the LISP programming language in 1958
    D. The victory of the Deep Blue computer system over the chess world champion, Gary Kasparov, in 1998

(1 mark)

Q2   A problem in which the agent needs to receive some information through its sensors in order to decide which action to take is a

    A. single-state problem
    B. multiple-state problem
    C. contingency problem
    D. exploration problem

(1 mark)

Q3   Local search, such as hill-climbing,

    A. operates using many current states
    B. uses more memory than depth-first search
    C. is not suited for pure optimization problems
    D. does not retain the paths followed by search

(1 mark)

Q4   Which of the following techniques uses randomness for avoiding getting trapped in local maxima?

    A. Best first search
    B. Local beam search
    C. Simulated annealing
    D. Gradient descent

(1 mark)

Q5   Machine learning is

    A. the autonomous acquisition of knowledge through the use of computer programs
    B. the autonomous acquisition through the use of manual programs
    C. the selective acquisition of knowledge through the use of computer programs
    D. the selective acquisition of knowledge through the use of manual programs

(1 mark)

Q6. Which of the following statement is true for neural network
   (i)   The training time depends on size of the network
   (ii)   Neural networks can be simulated on a conventional computer
   (iii) Artificial neural are identical in operation to biological ones

   A. All of the above
   B. (ii) is true
   C. (i) and (ii) are true
   D. None of the above

(1 mark)

Q7 The process by which the brain orders actions needed to complete a specific task is referred as _____.

   A. planning problem
   B. partial order planning
   C. total order planning
   D. Both A and B

(1 mark)

Q8 Translate the following statement into First Order Predicate Logic

   "For every A, if A is a Master student, then A has a bachelor degree

   A. $\forall$ a Master (A) $\rightarrow$ Degree (A)
   B. $\exists$ a Master (A) $\rightarrow$ Degree (A)
   C. $\wedge$ a Master (A) $\rightarrow$ Degree (A)
   D. $\neg$ a Master (A) $\rightarrow$ Degree (A)

(1 mark)

Q9 A Perceptron is

   A. a single layer feed-forward neural network with pre-processing
   B. an auto-associative neural network
   C. a double layer auto-associative neural network
   D. a neural network that contains feedback

(1 mark)

Q10 A 4-input neuron has weights 1, 2, 3, 4. The transfer function is linear with the constant of proportionality being equal to 2. The input are 4, 10, 5 and 20 respectively, the output are 4, 10, 5, and 20 respectively. The output will be

   A. 238
   B. 76
   C. 119
   D. 123

(1 mark)

SECTION B

Q11.   Translate this sentence into first order predicate logic.

(a)   Popeye loves spinach

(1 mark)

(b)   Every apple is either green or yellow

(1 mark)

(c)   No person likes a smart vegetarian

(1 mark)

(d)   All horses have four legs as well as two eyes

(1 mark)

(e)   Stalin was a dictator and not an Ancient Greek

(1 mark)

Q12   Verify the following representation

(a)   Is $p \lor \neg p$ valid?

(1 mark)

(b)   In which models is $\neg p \rightarrow q$ valid?

(2 marks)

(c) Show that $\neg[p \vee \neg(\neg q \vee \neg r)]$ is logically equivalent to $(p \vee q) \to \neg(p \vee r)$.

(5 marks)

(d) Proof the following models are tautology or inconsistency

    (i) $(\ \text{not}\ (\ P\ )\ \text{or}\ Q\ ) \leftrightarrow (\ P \to Q\ )$

(3 marks)

    (ii) not (not (P)) and not (P)

(3 marks)

Q13 (a) Define basic form of inference techniques *Modus Ponens, Modus Tollens, Hypothetical Syllogism.*

(6 marks)

(b) Given a knowledge based below. Explain how the backward-chaining inference work (Assume B and E are TRUE)

A → H
B → C
A ^ D → F
C ^ E → F
F v H → G

(6 marks)

(c) Proof the location (mimi, library), using resolution method

RULE1   female(mimi)
RULE2   friend_of(mimi,mike)
RULE3   day(saturday)
RULE4   ¬ (sunny(saturday))
RULE5   patient(mimi)
RULE6   ¬female(X) ∨ ¬patient(X) ∨ good_friend(X)
RULE7   ¬good_friend(X) ∨ ¬friend_of(X,Y) ∨ ¬location(Y,Z) ∨ location(X,Z)
RULE8   ¬day(saturday) ∨ ¬sunny(saturday) ∨ location(mike,cafeteria)
RULE9   ¬day(saturday) ∨ sunny(saturday) ∨ location(mike,library)

Prove: location(mimi,library)

(7 marks)

Q14 Consider a *k* state space where the start state is the number 1 and each state *k* has two successors: numbers *2k* and *2k+1*.

(a) Draw the portion (search tree) of the state space for states 1 to 15

(7 marks)

(b) Suppose the goal state is 11. List the order in which nodes will be visited for

(i) Breadth-first search

(2 marks)

(ii) Depth limited search with limit 3

(2 marks)

(iii) Iterative deepening search

(3 marks)

(c) How do heuristic search techniques such as Uniform-Cost Search and A* search differ from uninformed search techniques such as Depth-first search (DFS)/ Breadth-first search (BFS)?

(1 mark)

(d) How do the two heuristic search algorithms Uniform-Cost Search and A* search differ from each other?

(1 mark)

Q15.   Consider the following 8-puzzle problem as shown in FIGURE Q15

Initial State		
2	8	3
1	6	4
7		5

Goal state		
1	2	3
8		4
7	6	5

FIGURE Q15

Let h(n) be the sum of distance out of place. When this evaluation is applied to initial state, its h(n) value is 5. The value of 5 is obtained by the following steps below:

- Compare the current state with a goal state to identify the tiles out of place (wrong tiles)
- For each of the wrong tiles, calculate the cost of moving it horizontally or vertically or combination of both directions
- Total the cost of moving all the wrong tiles in the current state in order to get heuristic value

In the above problem, you will get the h(n) of the initial state (which is 5) by comparing the state with the goal state. This will enable you to identify 4 wrong tiles (tiles 1, 2, 6 and 8). Then calculate the cost of moving each of these tiles according to the steps mentioned above.

Calculation for the initial state has been done for you as follows:

Cost of moving tile 2 horizontally	1
Cost of moving tile 1 vertically	1
Cost of moving tile 8 horizontally and vertically	2
Cost of moving tile 6 vertically	1
Total	5

(a)   Construct the state space for the above problem using A* algorithm

Space Using A* Algorithm Method (Distance Out of Place, h(n)).

$$f(n) = g(n) + h(n)$$

where,

n is any state encountered in the search.
$g(n)$ is the cost of n from the start state.
$h(n)$ is the heuristic estimate of the cost of going from n to a goal.

(12 marks)

(b) Briefly describe how simulated annealing works. In particular, precisely explain how the algorithm behaves at very high temperatures, and how it behaves at very low temperatures.

(4 marks)

Q16 Artificial Neural Networks (ANNs) is an information processing system that has certain performance characteristics in common with biological neural networks.

(a) Describe the relationship between ANNs and biological neuron.

(5 marks)

(b) What is weight? Why weight initialization is so important?

(5 marks)

(c) Why are multilayer neural networks having more ability in problem solving?

(5 marks)

(d) Draw a diagram of a Neural Network that consists of 5 inputs units, two hidden layers (each with 3 hidden units) and 2 output units. What activation function is suitable for the network? Why?

(5 marks)

- **END OF QUESTIONS** -