Infrastructure University
Kuala Lumpur

SUNWAY
INT'L BUSINESS SCHOOL

FINAL EXAMINATION
SEPTEMBER / OCTOBER SEMESTER 2018

ARTIFICIAL INTELLIGENT
(CSC 3200)

(TIME : 3 HOURS)

MATRIC NO.   :

IC. / PASSPORT NO. :

LECTURER   : SANTOSH KHANAL

GENERAL INSTRUCTIONS

1. This question booklet consists of 6 printed pages including this page.
2. Answer **ALL question** in the **ANSWER BOOKLET**.

SECTION A   **(40 MARKS)**

There are FOUR (4) short answers questions in this section. Answer ALL Questions in the Answer Booklet.

1. **English to FOL Conversion.** For each English sentence below, write the FOL sentence that best expresses its intended meaning. Use Person(x) for "x is a person," Food(x) for "x is food," and Likes(x, y) for "x likes y."

    a) "Every person likes every food."

                                                                           (2 marks)

    b) "For every food, there is a person who likes that food."

                                                                           (2 marks)

    c) "There is a person who likes every food."

                                                                           (2 marks)

    d) "Some person likes some food."

                                                                           (2 marks)

    e) "There is a food that every person likes."

                                                                           (2 marks)

2. Using FIVE (5) of knowledge representation, explain how knowledge may be represented in the knowledge base.

                                                                           (10 marks)

3. Describe the advantages and disadvantages of an expert system.

                                                                           (10 marks)

4.
    a) What is artificial intelligence?

                                                                           (4 marks)

    b) Why are Artificial Neural Networks worth studying?

                                                                           (6 marks)

SECTION B

There are TWO (2) questions in this section. Answer ALL Questions in the Answer Booklet.

1.

a) Define the following terms with respect to production system
   i.   The set of production rules
   ii. Working memory
   iii. The recognize-act cycle

(6 marks)

b) The following is the rule set of a simple weather forecast expert system:
   R1: IF cyclone THEN clouds
   R2: IF anticyclone THEN clear sky
   R3: IF pressure is low THEN cyclone
   R4: IF pressure is high THEN anticyclone
   R5: IF arrow is down THEN pressure is low
   R6: IF arrow is up THEN pressure is high

   i.   Use forward chaining to reason about the weather if the working memory contains the fact: arrow is down. Show your answer in a table naming the rules matching the current working memory (conflict set), which rule you apply, and how the working memory contents changes on the next cycle after a rule has fired:

Cycle	Working Memory	Conflict set	Rule fired

   (7 marks)

   ii. Use backward chaining to reason about the weather if the working memory contains the fact: clouds. Show your answer in a similar table.

   (7 marks)

2.

a) List and explain FIVE (5) advantages of using Semantic Networks for representing knowledge.

(10 marks)

b) Create a semantic network to describe a car. Your network should include these concepts: *car, person, driver, engine, petrol, petrol tank,* and *road.*

(10 marks)

There are TWO (2) questions in this section. Answer any ONE (1) Question in the Answer Booklet.

1.
   a) Consider the following map in Figure 1.

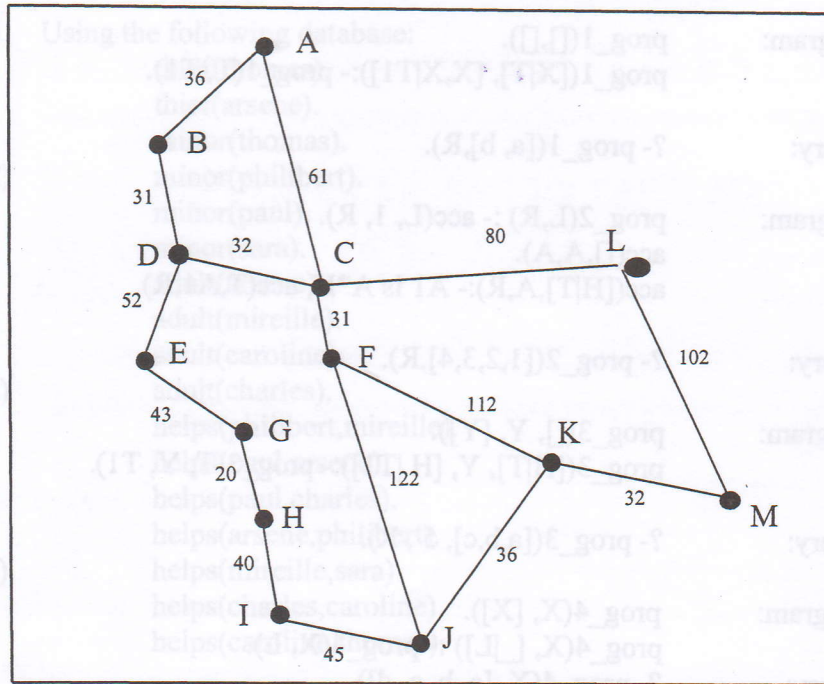   (16 marks)

Figure 1: MAP

Using the A* algorithm work out a route from town A to town M. Use the following cost functions.

➢ G(n) = The cost of each move as the distance between each town (shown on map).
➢ H(n) = The Straight Line Distance between any town and town M. These distances are given in the table below.
   Provide the search tree for your solution and indicate the order in which you expanded the nodes. Finally, state the route you would take and the cost of that route.

Straight Line Distance to M

A	223		E	165		I	100		M	0
B	222		F	136		J	60			
C	166		G	122		K	32			
D	192		H	111		L	102			

b) The straight line distance heuristic used above is known to be an admissible heuristic. What does this mean and why is it important?

(4 marks)

2.

a) Read the following programs and provide the answer to the query (only the first answer that SWI-Prolog would produce).

    i.   Program: prog_1([],[]).
                      prog_1([X|T], [X,X|T1]):- prog_1(T, T1).

            Query: ?- prog_1([a, b],R).

(2 marks)

    ii. Program: prog_2(L,R) :- acc(L, 1, R).
                      acc([],A,A).
                      acc([H|T],A,R):- A1 is A*H, acc(T,A1,R).

            Query: ?- prog_2([1,2,3,4],R).

(2 marks)

    iii. Program: prog_3([], Y, [Y]).
                      prog_3([H|T], Y, [H |T1]):- prog_3(T, Y, T1).

            Query: ?- prog_3([a,b,c], 5 , R).

(2 marks)

    iv. Program: prog_4(X, [X]).
                      prog_4(X, [_|L]) :- prog_4(X, L).
            Query: ?- prog_4(X, [a, b, c, d]).

(2 marks)

    v.   Program: prog_5([X|Xs], 1, Xs).
                      prog_5([Y|Xs], K,[Y|Ys]) :-
                                  K > 1,
                                  K1 is K - 1,
                                  prog_5(Xs, K1, Ys).

            Query: ?- prog_5([a, b, c, d], 2, R).

(2 marks)

b) Facts and rules in Prolog
In the country of N9 the penal code contains the following laws:

        All the thieves are criminals.
        All the persons who help a criminal are also criminals.
        The adult criminals go to prison.
        The minor criminals go to a correction house.

    i. Write a Prolog program to replace the judge in the courthouse. Translate the laws into Prolog, using the following symbols for predicates:

thief(X): X is a thief
criminal(X): X *is a criminal*
helps(X,Y): X *helps* Y
adult(X): X *is an adult*
minor(X): X *is a minor*
prison(X): X *goes to prison*
correction(X): X *goes to the correction house*

(4 marks)

ii. Using the following database:
```
thief(thomas).
thief(arsene).
minor(thomas).
minor(philibert).
minor(paul).
minor(sara).
adult(arsene).
adult(mireille).
adult(caroline).
adult(charles).
helps(philibert,mireille).
helps(paul,arsene).
helps(paul,charles).
helps(arsene,philibert).
helps(mireille,sara).
helps(charles,caroline).
helps(caroline,thomas).
```

What Prolog query do you need to ask for finding all the persons who go to prison?

(2 marks)

What are the Prolog answers if you press ; after each solution ?

(1 mark)

What Prolog query do you need to ask for finding all the persons who go to the correction house?

(2 marks)

What are the Prolog answers if you press ; after each solution ?

(1 mark)

*** END OF QUESTIONS ***