CONFIDENTIAL

Infrastructure University Kuala Lumpur

FINAL EXAMINATION
JUNE SEMESTER 2017

ARTIFICIAL INTELLIGENCE
(CSC 3200)

(TIME : 3 HOURS)

MATRIC NO. : | | | | | | | | | |

IC. / PASSPORT NO. : | | | | | | | | | | | | | | |

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GENERAL INSTRUCTIONS

1. This question booklet consists of 7 printed pages including this page.
2. Answer **ALL questions** in **section A, B and C in** the **ANSWER BOOKLET**.

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INSTRUCTIONS: **TIME: *3 HOURS***

SECTION A **(40 MARKS)**

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

1. Answer the following questions:

   a) What are the FOUR (4) different kinds of agent programs?

   (4 marks)

   b) List FIVE (5) steps involved in simple problem solving agent.

   (5 marks)

   c) Define in your own words the following terms:

      i. State.

      (1 mark)

      ii. State space.

      (1 mark)

      iii. Search tree.

      (1 mark)

      iv. Search node.

      (1 mark)

      v. Goal

      (1 mark)

2. For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties.

   - Playing soccer.
   - Exploring the subsurface oceans of Titan.
   - Shopping for used AI books on the Internet.
   - Playing a tennis match.
   - Practicing tennis against a wall.
   - Performing a high jump.
   - Knitting a sweater.
   - Bidding on an item at an auction.

   (16 marks)

3. Explain why problem formulation must follow goal formulation.

(5 marks)

4. Describe the difference between any path searches and optimal searches. Support your answer with example for each type.

(5 marks)

SECTION B **(30 MARKS)**

There are THREE (3) questions in this section. Answer ALL questions in the Answer Booklet.

1. Your goal is to navigate a robot out of a maze. The robot starts in the center of the maze facing north. You can turn the robot to face north, east, south, or west. You can direct the robot to move forward a certain distance, although it will stop before hitting a wall.

    a) Formulate the problem above.

    (2 marks)

    b) How large is the state space?

    (1 mark)

    c) In navigating a maze, the only place we need to turn is at the intersection of two or more corridors.

        i. Reformulate this problem using this observation.

        (2 marks)

        ii. How large is the state space now?

        (1 mark)

    d) From each point in the maze, we can move in any of the four directions until we reach a turning point, and this is the only action we need to do.

        i. Reformulate the problem using these actions.

        (2 marks)

        ii. How large is the state space?

        (1 mark)

    e) In our initial description of the problem we already abstracted from the real world restricting actions and removing details. List THREE (3) such simplifications we made.

    (3 marks)

2. A budget ariline company operates 3 plains and employs 5 cabin crews. Only one crew can operate on any plain on a single day, and each crew cannot work for more than two days in a row. The company uses all planes every day. A Genetic Algorithm is used to work out the best combination of crews on any particular day.

    a) Suggest what chromosome could represent an individual in this algorithm?

    (2 marks)

b) Suggest what could be the alphabet of this algorithm?

(1 mark)

c) What is the size of it?

(1 mark)

d) Suggest a fitness function for this problem.

(2 marks)

e) How many solutions are in this problem?

(2 marks)

f) Is it necessary to use Genetic Algorithms for solving it?

(2 marks)

g) What if the company operated more plains and employed more crews?

(2 marks)

3. Consider the problem of finding the shortest route through several cities, such that each city is visited only once and in the end return to the starting city (the Travelling Salesman problem). Suppose that in order to solve this problem we use a genetic algorithm, in which genes represent links between pairs of cities. For example, a link between London and Paris is represented by a single gene 'LP'. Let also assume that the direction in which we travel is not important, so that LP = PL.

   a) How many genes will be used in a chromosome of each individual if the number of cities is 10?

   (2 marks)

   b) How many genes will be in the alphabet of the algorithm?

   (4 marks)

SECTION C **(30 MARKS)**

There is TWO (2) question in this section. Answer ALL question in the Answer Booklet.

1. Given the Prolog database and rules shown below, Answer the following questions:

```
child_of(mary, steve).
child_of(mary, anne).
child_of(alice, anne).
child_of(alice, steve).
child_of(jane, steve).
child_of(leslie, steve).
child_of(steve, ema).
child_of(sally, ema).
child_of(anne, nani).
child_of(anne, john).
child_of(james, john).

female(mary).
female(alice).
female(jane).
female(nani).
female(ema).

sisters(Person1, Person2) :-
   child_of(Person1, Parent1),
   child_of(Person1, Parent2),
   child_of(Person2, Parent1),
   child_of(Person2, Parent2),
   not(Parent1 = Parent2),
   female(Person1),
   female(Person2),
   not(Person1 = Person2).
```

a) Add the following rules:

i. Define a predicate `brother(X,Y)` which holds iff `X` and `Y` are brothers.

(2 marks)

ii. Define a predicate `grandmother(X,Y)` which holds iff `X` a grandmother of `Y`.

(2 marks)

iii. Define a predicate `uncle(X,Y)` which holds iff `X` a an uncle of `Y`.

(2 marks)

iv. Define a predicate `husband(X,Y)` which holds iff `X` is the hunsband of `Y`.

(2 marks)

v. Define a predicate `brother_in_law(X,Y)` which holds iff `X` is brother of `Y`'s spouse.

(2 marks)

b) Based on the given code above, What is the output of the following queries?

i. `sisters(Sis1, Sis2).`

(4 marks)

ii. `grandmother(X,Y)`

(6 marks)

2. There is a monkey at the door into a room and a key in the middle of room. At the window of the room there is a banana locked in the box. The monkey should use the key to unlock the box to get banana. The monkey can perform the following action: walk, pick the key, unlock the box and get the banana. Write a prolog program to answer whether the monkey can get banana. The query is

```
?- canget(state( atdoor, lock, hasnot, hasnot)).
    canget(state(S1, S2, S3, S4))
      S1: monkey location
      S2: box is lock or not
      S3: monkey has the key or not
      S4: monkey has the banana or not
```

(10 marks)

***** END OF QUESTIONS *****