

Mobile Robotics I

COMP 4500 Midterm, Spring 2018

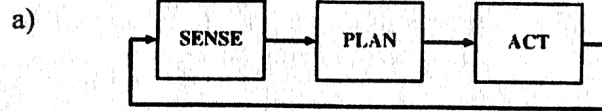
Name: Dangnhi Ngue Ngo

There are 9 pages in this exam. You have 75 minutes to complete this closed book exam. If you have any questions, please ask the TA. If he is unable answer your question, he will text me.

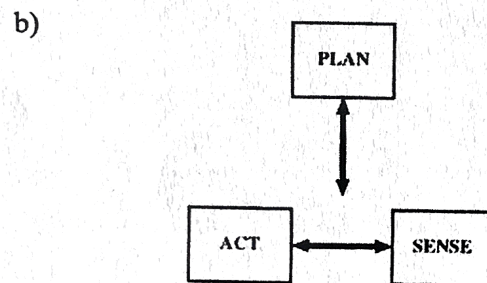
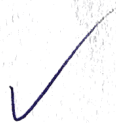
Problem	Points	Score
1	10	10
2	10	10
3	20	15
4	20	5
5	20	20
6	20	20
EC	5	0
Total	100	80

Problem 1 (10 points)

For each diagram below, put an X next to the name of the type of robot architecture that it represents.



- ☒ Hierarchical Architecture
☐ Reactive Architecture
☐ Hybrid Architecture

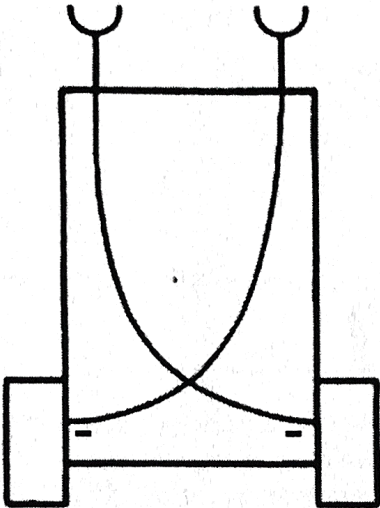
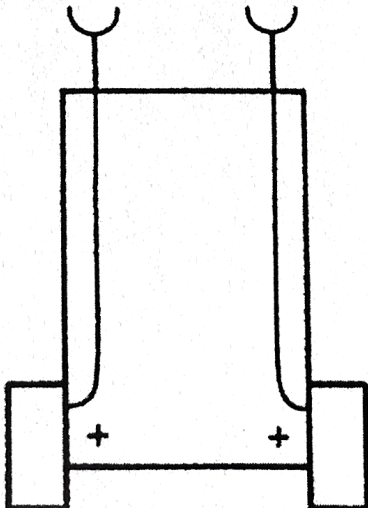


- ☐ Hierarchical Architecture
☐ Reactive Architecture
☒ Hybrid Architecture




Problem 2 (10 points)

Circle TRUE or FALSE for each of the following questions.

TRUE	FALSE	The following Braitenberg vehicle is attracted to light. 
TRUE	FALSE	The following Braitenberg vehicle is attracted to light. 

Problem 3 (20 points)

Circle TRUE or FALSE for each of the following questions.

 TRUE	FALSE	The RGB color space is better to use than the HSV color space if you need your robot to work in a variety of <u>lighting conditions</u> without recalibration.
TRUE	FALSE	The Canny edge detection algorithm starts by filtering the image to blur very small details.
TRUE	FALSE	Reactive architectures have a <u>horizontal</u> decomposition.
TRUE	FALSE	Reactive architectures were developed in response to hierarchical architectures, to show that stimulus/response behaviors could lead to robots that could move more quickly and effectively.

Problem 4 (20 points)

Provide 1-3 sentence answers for the following questions:

a) How does the median blur filter work?

The median blur filter is one of the filter types in detecting the image in computer vision.

It works by filtering the image to blur.

how?
-10

b) When/why would you use `disable_servos()` ; ?

I use `disable_servos()` to make the servo stop running.

It is different from `enable_servos()` which makes the servo active.

If we do not use `disable_servos()`, the servos just keep running without stopping.

Problem 5 (20 points)

a) What is an active sensor?

An active sensor will emit energy into the environment to make the observations.



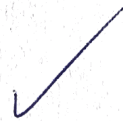
b) Name one active sensor from your robot kit.

infrared or sonar



c) What is a passive sensor?

A passive sensor will receive energy already existing in the environment.



d) Name one passive sensor from your robot kit.

camera




Problem 6 (20 points)

In this problem, you need to design a robot that will avoid negative obstacles in the front of the robot. A negative obstacle is a drop off such as the edge of a table or the top of a staircase. Your design will prevent the robot from driving off of the edge of a table, off the top of a staircase, or over the edge of a balcony to a room below.

a) What type of sensor will you use to detect the negative obstacle? Why did you select this sensor?

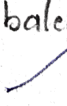
To detect the negative obstacle, we should use ET sensor. Because when the robot approaches nearly to the negative obstacles this sensor will detect and print out the values that are different from ones when the robot is on the surface, which prevents robot from driving off of the edge.



b) Where will you mount the sensor and in which direction will it point?

I will mount the sensor underneath the robot near the front. It will point down to the ground.

This way can help the robot detect the edge of the table, off the top of a staircase or over the edge of a balcony.



Problem 7 continued

c) Write pseudocode to keep the robot from going over a negative obstacle. (You may choose to write actual code if you prefer, but what I'm looking for is the algorithm that you'd implement on the robot to get it to avoid negative obstacles.) You only need to describe what will need to happen to avoid negative obstacles – do not worry about other types of obstacle avoidance or behaviors. Assume that the robot has a right and left motor to control its movement, with a caster to provide balance.

- Assume that the sensor is plugged into analog 0. The motor right and left are plugged into port 0 and 1, respectively.
- When the robot is moving on the ground, this sensor will print out the value that makes the robot understand that it can keep going straight with no any obstacles.

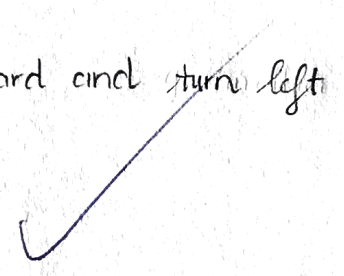
For example: the value is in the range from 2000 – 2500.

- When the robot approaches nearly the negative obstacle, this sensor will print out another value. For example: less than 1900. Then, the robot will go backward and turn into another direction.

For example:

```
// no negative obstacles, go straight
if (analog(0) > 2000 && analog(0) < 2500)
{
    motor(0, 50);
    motor(1, 50);
    msleep(700);
}

// detect negative obstacles, go backward and turn left
if (analog(0) < 1900)
{
    motor(0, -50);
    motor(1, -50);
    msleep(700);
    motor(0, 50);
    motor(1, -50);
}
```



Extra Credit (5 points)

What's the name of the first AI robot from 1967?

