Androids: Design and Practice, Spring 2002
Final Exam

Professor Douglas Blank

Answer 4 of the following 7 questions, 1 each from each numbered group (question 4 has no option). Use sophisticated technical jargon where appropriate. Write (or type) in complete, well-organized answers. If you have any questions, please email me at dblank@brynmawr.edu. Good luck!

1a. Image that you are given the task to design a robotics system that will roam the halls of Bryn Mawr College. If the robot were to encounter a person, it will ask them their name. If it encounters the same person again at some point in the future, it should recognize them, and tell them the location of the last place it saw them. Provide an overview of how you would go about really solving this problem with the tools and techniques that you know. What would be the hardest parts of the problem, and how would you solve them?

1b. Image that you are given the task to design a robotics camera system that will be used in a distance education classroom. The idea is to design a control system for a set of cameras that would allow the cameras to follow the instructor as they walked about the room, and automatically switch from one camera (view) to another, like a director would. All of this would happen without any human camera operators or directors. Provide an overview of how you would go about really solving this problem with the tools and techniques that you know. What would be the hardest parts of the problem, and how would you solve them? (Assume that you have computers that will operate in real time).

2a. What kinds of tasks are currently impossible (or very hard to accomplish) in Pyro? What things could be added to help this deficit? Provide a sketch of such additions and how they would work.

2b. What could be added to Pyro to make more sophisticated robot behaviors? Describe a set of changes to make to Pyro and how they would work.

3a. Consider a camera on a Pioneer2AT robot. Using the blobification software and Pyro, sketch out some (pseudo) code that could be used to steer the robot towards the largest blob in the scene. Don't worry about other problems, such as getting too close to the blob, obstacle avoidance, etc.

3b. Consider a camera on a B21R, like Elektro. Imagine performing gesture recognition such that the system could understand large sweeps of the hand in combination with comands like "go that way." Using tools that we have written this semester, sketch out a method for detecting the direction of such sweeping gestures.

4. Consider the following Pyro code. Without actually running the code, explain what each class, method, and function does (especially what you feel are key lines), and what the overall

program would do when run on a Pioneer2AT robot. Do you think it will it work? Any changes that you would make?

```
from pyro.brain.fuzzy import *
from pyro.brain.behaviors import *
from math import pi

class beh1 (Behavior):
    def init(self):
        self.Effects(`translate', .3)
        self.Effects(`rotate', .3)

    def direction(self, value):
        if value < 0:
            return -1
        else:
            return 1

    def update(self):
        self.IF(1, `translate', .2)
        self.IF(1, `rotate', 0)
        x = self.getRobot().getMin(`all', `range', range(7)).distance
        y = self.getRobot().getMin(`all', `range', range(7)).angle / pi
        self.IF(float(Fuzzy(.2, 2.0) << x),'translate', 0)
        self.IF(Fuzzy(0.0, 0.5) << x, `rotate', -self.direction(y))

class state1 (State):
    def init(self):
        self.add(beh1(1))

def INIT(robot):
    brain = BehaviorBasedBrain({`translate' : robot.translate, \
                                `rotate' : robot.rotate, \
                                `update' : robot.update }, robot)
    brain.add(state1(1))
    brain.init()
    return brain
```