BLG435E, Fall 2012, Assignment 2 & 3

Due: Jan, 7, 2013 23.00
Submission type: a softcopy report and an archive file

Important Note: Please work individually on your assignment and **give relevant references** (**this will also be graded**).

The answers for 1, 2(a), 2(b), 4(a) and 4(b) should be handwritten in your hardcopy report to be handed in the AI final examination. The archive file to be submitted through Ninova should include the code files (even you use an existing code for the inference algorithms), readme files to run the programs and the used input files, and the report for the questions **2(c), 3, 4(c),5**.

Grading: 1-20 2-50 3-30 4-50 5-50

1) Represent the following sentences in either propositional logic (PL) or first-order logic (FOL). Indicate which logic you used (PL or FOL) for the sentences.
   - "Only one player in a football team is a goal keeper."
   - "If the weather is cold and a restaurant only has outdoor seats available, John always drinks hot beverage in there."

2) There are three people of unique nationality: British, German and Swedish. Each person drinks a unique beverage: coffee, milk, and tea. Each person chew a unique gum brand: Mentos, BigBabol and Trident. Each person keeps a unique pet: Cats, birds and dogs. The following facts are given:
   - The Swedish drinks tea.
   - The German keeps dog.
   - The person who chews BigBabol also keeps birds.
   - The man keeping dog drinks milk.
   - The man who keeps birds, does not drink tea.
   - The man who chews Mentos drinks milk.

   a. Construct the knowledge-base by using the given facts.
   b. Use **resolution** to find who chews trident.
   c. Pick two inference algorithms (you can use the codes from the aima code base) and run these algorithms for the given knowledge-base and the entailed sentence. Report your selected algorithms, results and your analysis.

3) Devise a **novel** planning problem that you create (It may be a simple one as we discussed in the class. e.g., the blocks world or the spare tire problem. But it should definitely be **novel**.). Your problem may be easy enough for a human to solve but may force the Partial Order Planner (POP) to backtrack.

   Represent this problem in the STRIPS language. Apply POP on this problem (by hand) showing a case that the POP backtracks, and then, finds the solution. Draw each step during the planning.

4) Assume that you have the following objects and the training set for the given objects. We have a mobile robot that is tasked to pick up these objects and move to a desired location. Unfortunately, some of the objects cannot be picked up by the robot. The success and failure cases are given in this training set.

Object Name	Type	Color	Depth	Width	Height	Material	Shape	Successful
purple_ball	ball	purple	0.10	0.10	0.10	Plastic	spherical	Yes
yellow_ball	ball	yellow	0.10	0.10	0.10	Plastic	spherical	Yes
big_yellow_ball	big_ball	orange	0.16	0.16	0.16	Plastic	spherical	No
orange_ball	ball	orange	0.10	0.10	0.10	Plastic	spherical	Yes
pink_ball	ball	pink	0.10	0.10	0.10	Plastic	spherical	Yes
big_red_ball	big_ball	pink	0.16	0.16	0.16	Plastic	spherical	No
red_pin	pin	red	0.08	0.08	0.22	Plastic	cylindrical	No
orange_pin	pin	orange	0.08	0.08	0.22	Plastic	cylindrical	No
yellow_pin	pin	yellow	0.08	0.08	0.22	Plastic	cylindrical	No
blue_pin	pin	blue	0.08	0.08	0.22	Plastic	cylindrical	No
green_pin	pin	green	0.08	0.08	0.22	Plastic	cylindrical	No
red_cylinder	cylinder	red	0.11	0.11	0.24	Paper	cylinder	Yes
green_cylinder	cylinder	green	0.11	0.11	0.24	Paper	cylinder	Yes
black_box	box	black	0.12	0.12	0.12	Paper	cube	Yes
black_prism	box	black	0.15	0.28	0.15	Paper	prism	No
juice_box	box	yellow	0.07	0.07	0.23	Paper	prism	Yes
beach_ball	big_ball	white	0.19	0.19	0.19	Plastic	spherical	No
green_prism	box	green	0.07	0.13	0.38	Paper	prism	No
red_block	block	red	0.04	0.04	0.04	Paper	cube	Yes
green_block	block	green	0.04	0.04	0.04	Paper	cube	Yes
blue_block	block	blue	0.04	0.04	0.04	Paper	cube	Yes
brick	brick	grey	0.11	0.13	0.05	Foam	prism	No
bigger_brick	brick	grey	0.09	0.19	0.05	Foam	prism	No
frame	frame	grey	0.05	0.29	0.23	Foam	torus	No
tennis_ball	ball	green	0.07	0.07	0.07	Felt	spherical	No
triangle	brick	grey	0.05	0.16	0.14	Foam	prism	No
blue_box	box	blue	0.04	0.04	0.04	Plastic	cube	Yes
red_box	box	red	0.04	0.04	0.04	Plastic	cube	Yes
green_box	box	green	0.04	0.04	0.04	Plastic	cube	Yes
striped_prism	box	striped	0.10	0.10	0.235	Paper	prism	No

(a) Construct the decision tree for the given training set, indicating the intermediate steps.

(b) Using the decision tree that you construct, classify the following examples if the given objects can be picked up by the robot or not:

	Type	Color	Depth	Width	Height	Material	Shape
Object 1	block	Red	0.2	0.2	0.2	Paper	Cube
Object 2	ball	Green	0.07	0.07	0.07	Foam	spherical
Object 3	pin	Black	0.08	0.08	0.22	Plastic	cylindrical

(c) Either use an existing Decision Tree Learner code or write your own code to solve the given problem in Question 4 (a-b).

5) Choose one of the given domains and find the artificial intelligence methods/algorithms used in order to solve these domain specific problems. Describe how the methods are applied to these problems. (minimum 1000 words: appropriate visual materials are appreciated)

- Angry birds challenge (http://www.angrybirdsnest.com/challenge/)
- Ants ai-challenge (http://ants.aichallenge.org/)
- Tron ai-challenge (http://tron.aichallenge.org/)
- Planet wars ai-challenge (http://planetwars.aichallenge.org/)
- A strategy game (like age of empires or star craft)
- Netflix recommendation engine (http://www.netflixprize.com)