Written HW Assignment 1

[36+12+8+20+15+9=100pts]

This written homework focusses on Chapters 1-6. Your response should be well-thought-out, coherent, and concise. Quality of written expression will be a factor in the grading (please use full sentences). Short, to-the-point answers are preferred.

1.) [36 points, 18 = 3x6 each domain] Consider a pure software agent in the following two domains:

- An agent that manages a chronic medical condition for a person (e.g. tracking medicines, collecting health sensor data, coordinating doctor appointments, etc.)
- An agent that acts as a NPC (Non-Player Character) in a game with a significant story-telling component.

For each domain, consider the three (**pure**) architectural classes: Logical/Deductive (like Agent0/Concurrent MetateM), Practical BDI (like PRS), and Reactive (like Steels' Mars rovers or Brooks' and Maes' work). What would be the strengths and weaknesses of each architectural approach for each domain? ***[Consider all three pure approaches for each domain.]***

2.) [12 points]

Consider the environment $Env_1 = \langle E, e_0, \tau \rangle$ defined as follows:

$$E = \{e_0, e_1, e_2, e_3, e_4, e_5\}$$
$$\tau(e_0 \xrightarrow{\alpha_0}) = \{e_1, e_2, e_3\}$$
$$\tau(e_0 \xrightarrow{\alpha_1}) = \{e_4, e_5, e_6\}$$

There are just two agents possible with respect to this environment, which we shall refer to as Ag_1 and Ag_2:

$$Ag_1(e_0) = \alpha_0$$
$$Ag_2(e_0) = \alpha_1$$

Assume the probabilities of the various runs are as follows:

$$P(e_0 \xrightarrow{\alpha_0} e_1 \mid Ag_1, Env_1) = 0.7$$
$$P(e_0 \xrightarrow{\alpha_0} e_2 \mid Ag_1, Env_1) = 0.2$$
$$P(e_0 \xrightarrow{\alpha_0} e_3 \mid Ag_1, Env_1) = 0.1$$
$$P(e_0 \xrightarrow{\alpha_1} e_4 \mid Ag_2, Env_1) = 0.6$$
$$P(e_0 \xrightarrow{\alpha_1} e_5 \mid Ag_2, Env_1) = 0.3$$
$$P(e_0 \xrightarrow{\alpha_1} e_6 \mid Ag_2, Env_1) = 0.1$$

Finally, assume the utility function u_1 is defined as follows:

$$u_1(e_0 \xrightarrow{\alpha_0} e_1) = 10$$
$$u_1(e_0 \xrightarrow{\alpha_0} e_2) = 6$$
$$u_1(e_0 \xrightarrow{\alpha_0} e_3) = 5$$
$$u_1(e_0 \xrightarrow{\alpha_1} e_4) = 12$$
$$u_1(e_0 \xrightarrow{\alpha_1} e_5) = 3$$
$$u_1(e_0 \xrightarrow{\alpha_1} e_6) = 4$$

Given these definitions, determine the expected utility of the agents Ag_1 and Ag_2 with respect to Env_1 and u_1, and explain which agent is optimal with respect to Env_1 and u_1.

3.) [8 pts] Consider Snow White and her Concurrent MetateM friends the dwarves. Let's assume that dwarves can bid for sweets if they have the money, e.g. `dwarf1` might have the rules

⊚[money(N) ∧ N≥2] ⇒ ask(dwarf1,2)

⊚[money(N) ∧ give(dwarf1,C)] ⇒ money(N-C)

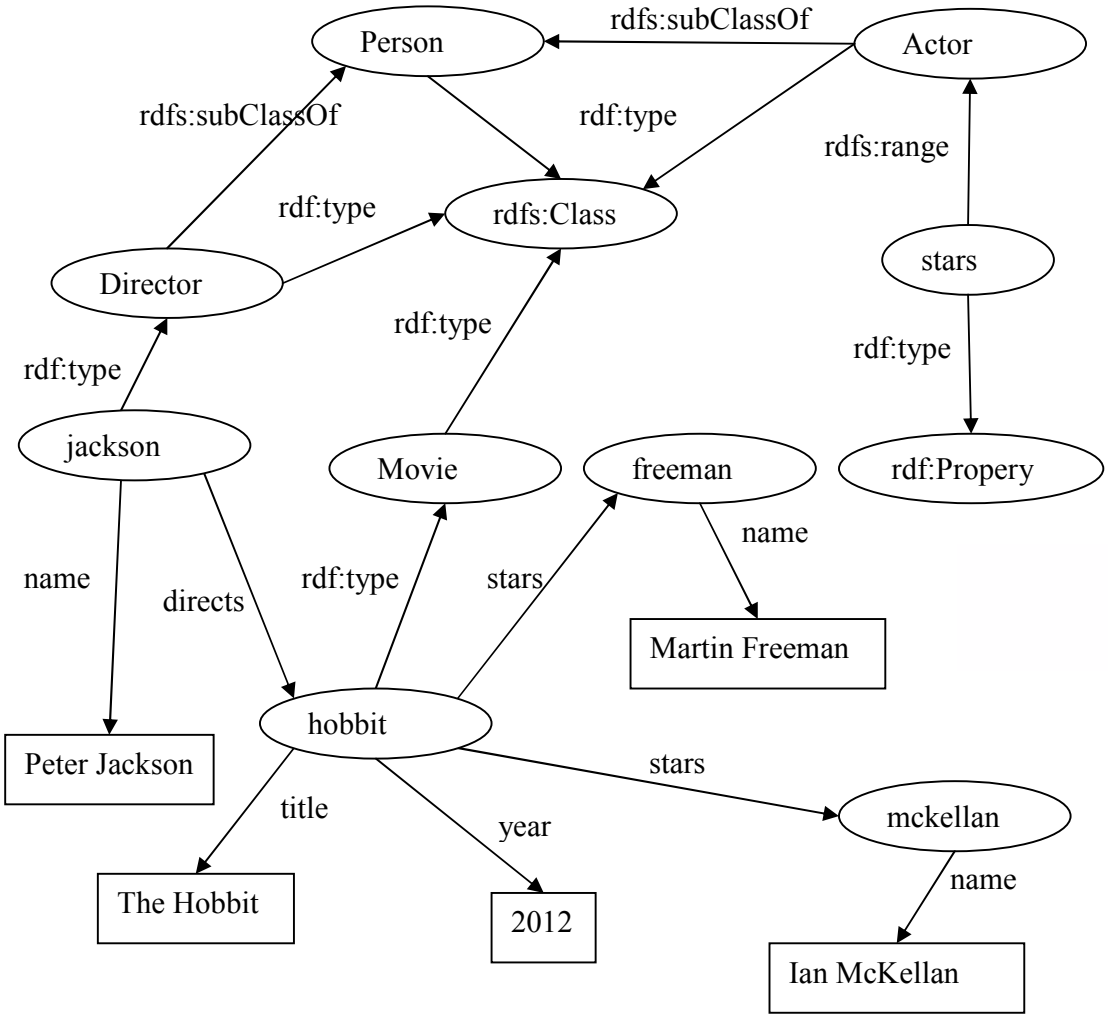
The first rule says that if `dwarf1` has at least $2 in money [money($N$) ∧ ($N \geq 2$)] in the previous state, then `dwarf1` will bid $2 [`ask(dwarf1,2)`]. The second rule says that if the bid is successful for the amount C and he had N in the previous state, then he will have $N - C$ money left in the current state.

Write a rule for `dwarf2` that says if `dwarf1` bids b, and b is higher than m (where `myLastBid(m)`, that is m is the amount of `dwarf2`'s last bid), that `dwarf2` will bid b+1 if he has the money (where `money(N)` is the amount of money the dwarf has).

4.) [20 pts] Consider a health coaching app running on a phone, smartwatch, or both to help the user increase their moderate-to-vigorous physical activity (MVPA). From a BDI design standpoint, what beliefs, desires, and intentions might be useful? Discuss issues involving deliberation, planning, and reconsideration for designing such an agent.

5.) [9 pts] According to the RDFS Schema recommendation, a property can have multiple `rdfs:range` statements. When this occurs the range of the property is treated as the **intersection** of the individual ranges. What advantage does this have over using the **union** of the individual ranges to determine the actual range? *[Hint: Consider the distributed design of RDF and the inferences that are sanctioned by* `rdfs:range`*.]*

6.) [15 points] Consider the following RDF graph:



Using the RDFS entailment rules rdfs2, rdfs3, rdfs5, rdfs7, rdfs9, and rdfs11 in Section 7.3 of the W3C RDFS semantics specification [http://www.w3.org/TR/2004/REC-rdf-mt-20040210/#rules], determine what triples can be inferred from the example above. (You may ignore the other entailment rules because they do not add anything particularly interesting here). Assume the square boxes contain literals (e.g. integer `2012`, string "`The Hobbit`"). You can extend the drawing, or write out the triples in a Turtle-like style (e.g. `hobbit rdf:type Movie. hobbit stars freeman.`). Don't sweat syntax.