Midterm Test Practice Questions

1. Explain in a line or two each of the following:

   a) symbol

   b) computational process

   c) logical entailment

   d) *recursive* predicate

   e) back-chaining

2. Suppose that we take the view that the objective of Artificial intelligence is to study how to produce systems that *act rationally*. From this point of view, would the Turing Test be an adequate way to evaluate progress in Artificial Intelligence? Justify your answer in 5 lines or less.

3. Consider the following Prolog program:

```
p(a,b). p(b,c). p(c,d).

q(X,Y):- p(X,Y).
q(X,Y):- p(X,Z), q(Z,Y).

r1(X,Y):- q(X,Y), q(X,Z), q(Y,Z).

r(X,Y):- q(X,Y), \+ r1(X,Y).
```

For each of the following queries, give *all* the values of `X` and `Y` for which the query succeeds:

a) `?- p(X,Y).`

b) `?- q(X,Y).`

c) `?- r(X,Y).`

4. Suppose that we have the following Prolog knowledge base:

```
% prerequisite(C1,C2) means that course C1 is a prerequisite of course C2
prerequisite(phil2100,phil3750).
prerequisite(phil2160,phil3750).
prerequisite(cse1020,cse1030).
prerequisite(cse1030,cse2021).

% passed(S,C) means that student S has passed course C
passed(john,cse1020).
passed(john,cse1030).
passed(mary,phil2100).
passed(mary,phil2160).

% grade(S,C,G) means that student S has received grade G in course C
grade(john,cse1020,77).
grade(john,cse1030,71).
grade(mary,phil2100,81).
grade(mary,phil2160,69).
```

a) Write Prolog clause(s) for the predicate `required(C1,C2).` A course C1 is required for a course C2 if C1 is a prerequisite of C2 or if there is some course C3 that is a prerequisite of C2 and C1 is required for C3.

b) Write Prolog clause(s) for the predicate `cant_take(S,C).` A student S can't take course C if there is a prerequisite of C that S has not passed.

c) Write Prolog clause(s) for the predicate `best_grade(S,G)`, which holds if G is the best (i.e. highest) grade that S has received in any course. (You may define auxiliary predicates.)

5. Consider the following logic puzzle. There are three children: John, Sandy, and Paul. We have three toys: a ball, a yoyo, and a Gameboy. Also, we have three snacks: an apple, a cupcake, and a donut. Each child must get a different toy and snack. Suppose that we have the following constraints:

   i) John does not like fruit,

   ii) the apple goes to the Gameboy player,

   iiii) Paul does not like cupcakes,

   iv) the Gameboy can only go to someone older than 6.

   We have written the following incomplete Prolog program to solve the puzzle as a constraint satisfaction problem:

```
solution(Ball,Yoyo,Gameboy,Apple,Cupcake,Donut) :-
   % distinct toys and snacks
   uniq_children(Ball,Yoyo,Gameboy),
   uniq_children(Apple,Cupcake,Donut),
   % CONSTRAINTS GO HERE

   .

uniq_children(A,B,C) :- child(A),  child(B),  child(C),
                        \+ A=B, \+ A=C, \+ B=C.

child(john).  child(sandy).  child(paul).
age(john,7).  age(sandy,8).  age(paul,5).
```

   a) Complete the program by writing below some Prolog code that represents the four constraints:

b) What is the domain of the variable `Ball`?

c) What is the size of the search space in this problem?

d) The program above is not very efficient. Briefly describe two general techniques that can be used to improve efficiency when solving constraint satisfaction problems.