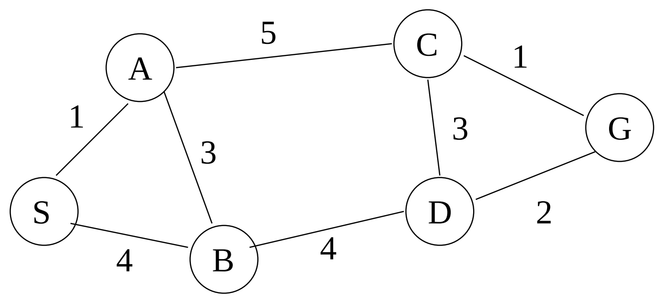
COSC 387 Homework #1 (Optional)

Fall 1998

1. For the figure below, trace the execution of the breadth-first search algorithm (without using the transition costs), as I did in class using the depth-first search algorithm, showing the intermediate values of each variable.



2. Repeat Problem 1 using the hill climbing search algorithm. Draw the search tree with transitions to visited states drawn as solid lines and transitions to expanded but unexplored states drawn as dashed lines. What was the path to the goal and its total cost? Was it the optimum? If not, what was the optimum path to the goal and its total cost?

3. Given the following, using resolution, can you prove that the unicorn is mythical? How about magical? Horned?

   If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

4. Convert the following sentences to clausal form:

   (a) $\forall x \forall y\, P(x, y) \rightarrow Q(x, y)$
   (b) $\forall x \forall y\, \neg Q(x, y) \rightarrow \neg P(x, y)$
   (c) $\forall x \forall y\, P(x, y) \& Q(x, y) \rightarrow R(x, y)$
   (d) $\forall x \forall y\, (P(x, y) \vee Q(x, y)) \rightarrow R(x, y)$

5. Determine whether the members of each of the following pairs of expressions unify with each other. If so, give the most general unifier; if not, give a brief explanation.

   (a) Color(Tweety, Yellow) and Color(x, y)
   (b) Color(Tweety, Yellow) and Color(x, x)
   (c) Color(Tweety, x) and Color(x, Tweety)
   (d) Color(Hat(Postman), Blue) and Color(x, x)
   (e) R(F(x), B) and R(y, z)
   (f) R(F(y), x) and R(x, F(B))
   (g) R(F(y), y, x) and R(x, F(A), F(v))

6. For each of the following, apply the substitution to the expression.

   (a) Color(x, y), {x/BigBird, y/Yellow}
   (b) Color(Hat(x), x), {x/Blue, y/Green}
   (c) R(F(x), P(x, y, Q(z))), {x/Pig, y/Fish, z/y}
   (d) P(x, x, y, v), {x/A, y/F(B), z/w}
   (e) {¬AnimalLover(x4), ¬Animal(y2), ¬Kills(x4, y2)} {x4/Jack, y2/Tuna}

7. For the following argument, symbolize the premises and conclusion in an appropriate representation, and use resolution to prove the conclusion from the premises.

   All computer scientists are weird. All computer scientists are rich. Allen is a computer scientist, and he is obnoxious. Therefore, some computer scientists are rich and obnoxious.

8. Define a formal production system that increments a binary number. That is, given any positive integer value represented in binary notation, define the production system that will increment the value by 1, leaving the new number in working memory. For example, if working memory contains the number 101_2, then after computation, working memory contents should be 110_2. To test your production system, increment the numbers 101_2 and 111_2.

9. Assume we want to build a rule-based system to identify sailboats. Using "CLIPS syntax", write the rules necessary to identify the sailboats pictured below. Represent or model only those attributes necessary for identification. List the questions that the system would have to ask a user in order to illicit the information needed to make an identification.