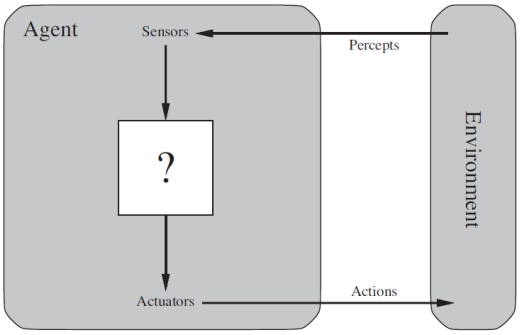
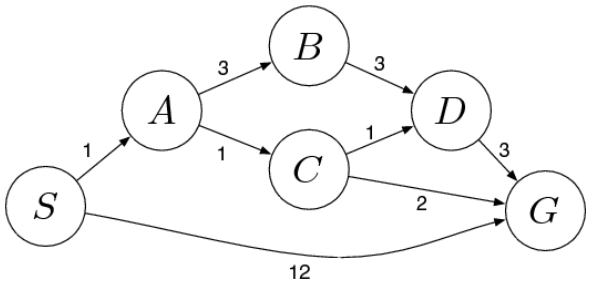
Test 1
Artificial Intelligence, Fall 2018
September 26, 2018
Total points = 25

1. (1 point) The performance of heuristic search algorithms depends on _____.
   the quality of the heuristic function
2. (1 point) In the context of Neural Networks, the _____ algorithm was applied to many learning problems in computer science and psychology, and it caused great excitement.
   Back-propagation algorithm
3. (1 point) What data structures do Breadth First search, Uniform-cost search, and Depth-first search use?
   Queue, priority queue, stack
4. (1 point) Uniform-cost search expands the node n with lowest g(n). What is g(n)?
   g(n) = cost of the path to g(n)
5. (2 points) Define the following terms - (a) an agent, and (b) a rational agent.
   Agent: Agent is anything that can be viewed as perceiving the environment through sensors and acting upon the environment through actuators.
   Rational agent: For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has.
6. (2 points) With example calculations, discuss the Manhattan distance (h2) heuristic for the 8-puzzle game.
7. (2 points) Draw a diagram showing the relationship between agent, sensors, actuators, environment, percepts, and actions.



8. (2 points) What are the four ways to evaluate the performance of an algorithm?
   Completeness, Optimality, Time complexity, and Space complexity
9. (2 points) A problem has a branching factor of 10. Only 2 nodes can be processed per second and only one-byte memory is needed per node. How much time is required to complete searching all the nodes up to (<=) level 4 of the search graph using Breadth First Search algorithm? Assume that the root node is level 1.
   At Level 1: 0.5
   At Level 2: 5
   At Level 3: 50
   At Level 4: 500
   Total = 555.5
10. (2 points) Write the Depth-first search algorithm.
11. (2 points) "The Availability of Very Large Datasets" has influenced the field of AI. How important is algorithm selection in this context? Answer in a single sentence.
    For many problems, it makes more sense to worry about the data and be **less picky** about what algorithm to apply.
12. (5 points) Show the contents of the priority queue in the following graph as Uniform cost search is applied to reach from state S to state G. **Assume that the contents of the priority queue are checked at the end of the 'do' loop**, i.e. as the last statement inside your do loop.

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function UNIFORM-COST-SEARCH(problem) returns a solution, or failure
  node ← a node with STATE = problem.INITIAL-STATE, PATH-COST = 0
  frontier ← a priority queue ordered by PATH-COST, with node as the only element
  explored ← an empty set
  loop do
    if EMPTY?(frontier) then return failure
    node ← POP(frontier)  /* chooses the lowest-cost node in frontier */
    if problem.GOAL-TEST(node.STATE) then return SOLUTION(node)
    add node.STATE to explored
    for each action in problem.ACTIONS(node.STATE) do
      child ← CHILD-NODE(problem, node, action)
      if child.STATE is not in explored or frontier then
        frontier ← INSERT(child, frontier)
      else if child.STATE is in frontier with higher PATH-COST then
        replace that frontier node with child
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A 1, G 12
C 2, B 4, G 12,
D 3, B 4, G 4
B 4, G 4