CSCI 3202
Sample Midterm Answers
October 6, 2025

Structure

- Exam will consist of:
  - Multiple Choice
  - True False
  - Short Answers
  - Worked Out Problems
- You **will** need a calculator and paper for the exam

Define the following terms as they apply to our search algorithms (2 points each, 10 points total)

- Optimal. Algorithm returns either the smallest path cost or fewest number of nodes visited.
- Complete. Algorithm returns a solution if one exists and reports to caller if one doesn't exits.
- Uninformed. Uses no information other than that supplied by the problem specification.
- Heuristic. A function that provides partial or incomplete information about the solution to a problem.
- Step Cost Function. Cost of moving a node to one of its children

Define the following as they relate to Bayes Networks (2 points each, 6 points total)

- Independence. Two events are not related in any way. Mathematically, $P(A,B)=P(A)*P(B)$
- Conditional Independence. Two events are not related or mostly unrelated with conditioned on another variable. Mathematically, $P(A,B|C)=P(A|C)*P(B|C)$
- Bayes Rule- Provides a mechanism for turning around a conditional probability. $P(A|B)= P(B|A)*P(A)/P(B)$. Used to find $P(A|B)$ when you know $P(A|B)$.

Multiple Choice

Question 1

Assume that the cost function is positive and > 0 where applicable and that any heuristic is admissible if needed

- Which of the following is optimal? (5 points)
  - BFS **
  - DFS
  - UCS **
  - Greedy
  - A* **

Question 2

Assume that the cost function is positive and > 0 where applicable and that any heuristic is admissible if needed

- Which of the following is complete? (5 points)
  - BFS **
  - DFS (Complete under some circumstances)
  - UCS **
  - Greedy
  - A* **

Other Questions

See the quizzes for other multiple choice examples

Short Answer

Question 1

- You have two heuristics, h1 and h2. h1 is the Manhattan distance and h2 is the euclidean (straight line) distance. If you apply these to an route finding problem from class (travel from Chicago to Providence):
  - Are both heuristics admissible? Why or why not? (10 points). No. Manhattan distance can overstate the distance from the current node to the goal.
  - If we use max(h1,h2) to create a new heuristic, will it be admissible? (5 points). No Manhattan distance can overstate the distance to the goal. When we take the max() of this distance, it will be overstated as well, making the new heuristic not admissible.

Question 2

- If we have two heuristics, h3 and h4, explain how you can tell which one will visit the fewest nodes? Why? (5 points). Assuming both are admissible, the one with the largest value will visit the fewest nodes. The largest values will push the estimated distance used in A* closer to the goal faster than one with smaller values, reducing the number of nodes.

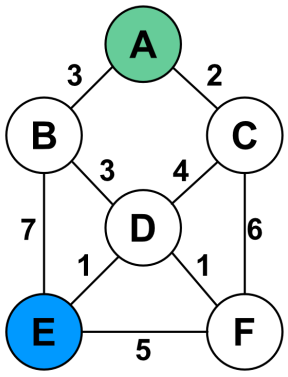
Question 3

- Why do we assume conditional independence in our Bayes Networks (5 points). Conditional independence allows us to calculate the probabilities of certain variables that are not found in our CPTs. In general, it simplifies the task of finding certain probabilities.

Worked Out Problems

Answers in Sample Midterm Problem Answers 2025.pdf

Question 1



Heuristic	
Node	h
A	3
B	1
C	2
D	1
E	0
F	1

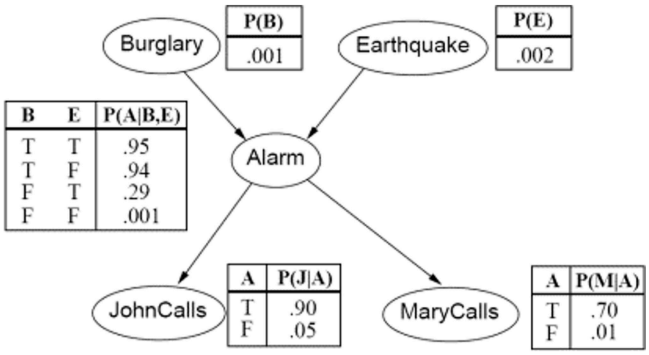
Numbers are step cost between nodes.
Heuristic is for destination E

- Given the graph above, use BFS to find an optimal route from node A to node E
  - Show the Frontier, Expanded nodes, and Visited nodes list for each step (10 points)
  - What is the optimal path (10 points)
  - What does optimality mean here? (5 points)

Question 2

- Using the same graph , use A* to find an optimal route from A to E
  - Show the Frontier, Expanded nodes, and Visited nodes list for each step (20 points)
  - What is the optimal path (10 points)
  - What does optimality mean here? (5 points)
  - Both BFS and A* are optimal. Why is the BFS path different from the A* path? (10 points)

Question 3



- Using the Burglar Alarm data given above do the following:
- Write the equation you would use to calculate P(A) using the data given in the problem (10 points)
- Calculate P(A) (5 points)
- Write the equation you would use to calculate $P(\overline{J})$ (J not) (15 points)
- John has called. There has been no earthquake. What is the probability you have been burglarized (15 points)
- The alarm has gone off. Calculate the probability it was caused by an earthquake (10 points)

End of Sample Midterm