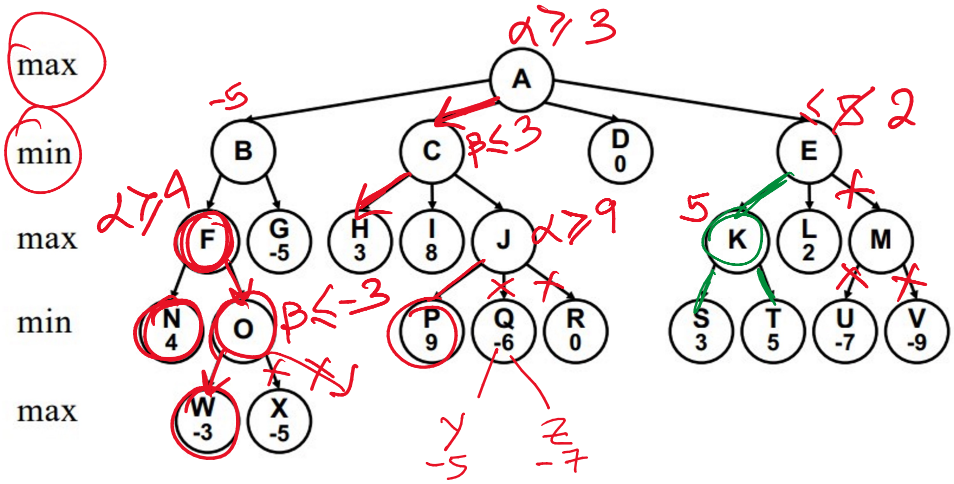
Alpha Beta

Wednesday, August 10, 2022 11:14 PM



$\alpha \geq \beta$ ← prune.

X3Q15

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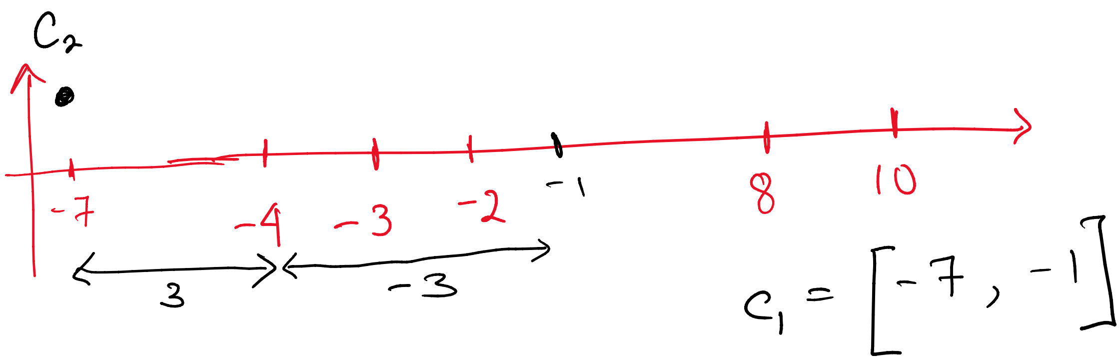
Question 15

- [4 points] Given the dataset $[8 \quad -2 \quad 10 \quad -4 \quad -3]$, the cluster centers are computed by k-means clustering algorithm with $k = 2$. The first cluster center is x and the second cluster center is -7. What is the maximum value of x such that the second cluster is empty (contains 0 instances). In case of a tie in distance, the point belongs to cluster 1.
- Answer: [ ]. Calculate



X4Q5

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Question 5

$|x_2 - x_1| + |y_2 - y_1|$

• [4 points] Consider A (A Search) search algorithm on the following grid, starting from state 0 with the goal state being 8, and one can move left, right, up, or down one step at a time (no wrapping around). The cost is the number of moves taken, and the heuristic is the Manhattan distance to the goal. Write down the expansion path (in the order of the states expanded). Break tie by expanding the state with a smaller index.

0 4	1 3	2 2
3 3	4 2	5 1
6 2	7 1	8 0

$a(s) = g(s) + h(s)$

P.Q.

Cost → g(s)

h(s)

a(s)

0 → 1 → 2 → 3 → 4 → 5 → 6 → 7 → 8

X4Q8-9

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Question 8

• [4 points] When using the Genetic Algorithm, suppose the states are $[1 \quad 0 \quad 1 \quad 0 \quad 0 \quad 0]$, $[0 \quad 0 \quad 1 \quad 0 \quad 0 \quad 1]$, $[1 \quad 0 \quad 1 \quad 1 \quad 0 \quad 0]$, $[1 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0]$. Let $T = 6$, the fitness function (not the cost) is $\text{argmin}_{t \in \{1,\ldots,T+1\}} x_t = 1$ with $x_{T+1} = 1$ (i.e. the index of the first feature that is 1). What is the reproduction probability of the state with the highest reproduction probability?

3, 1, 1, 1

$\frac{3}{1+3+1+1} = \frac{1}{2}$

• Answer: 1/2 Calculate

Question 9

• [4 points] When using the Genetic Algorithm, suppose the states are $[1 \quad 0 \quad 1 \quad 0 \quad 0 \quad 0]$, $[0 \quad 0 \quad 1 \quad 0 \quad 0 \quad 1]$, $[1 \quad 0 \quad 1 \quad 1 \quad 0 \quad 0]$, $[1 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0]$. Let $T = 6$, the fitness function (not the cost) is $\text{argmin}_{t \in \{1,\ldots,T+1\}} x_t = 1$ with $x_{T+1} = 1$ (i.e. the index of the first feature that is 1). What is the reproduction probability of the first state: $[1 \quad 0 \quad 1 \quad 0 \quad 0 \quad 0]$? 1/6

• Answer: 1/6 Calculate

M10Q9

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Question 9

- [4 points] In simulated annealing we move from s to an inferior neighbor t with probability $exp(\frac{-|f(s)-f(t)|}{T})$, where T is the temperature parameter. Suppose $f(s)$ = 9 and $f(t)$ = 4 and T = 10. What is the probability we move to t?

$f(s) > f(t) \longrightarrow$ prob : $s \rightsquigarrow t = 1$

M9Q3

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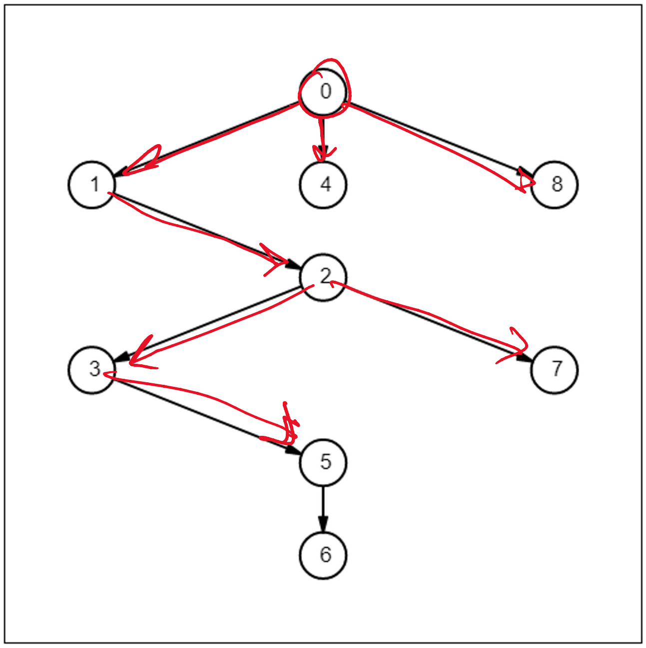
Question 3

• [4 points] Which order of goal check is possible with BFS (Breadth First Search), without specifying the order of successors when putting them in the queue (i.e. you can rearrange the order of the branches)?

• Note: some of the choices may be repeated, if you think the choice is correct, please select all repeated ones as well.



0 → 1 → 4 → 8 → 2 → 3 → 7 → 5 → 6

M9Q8

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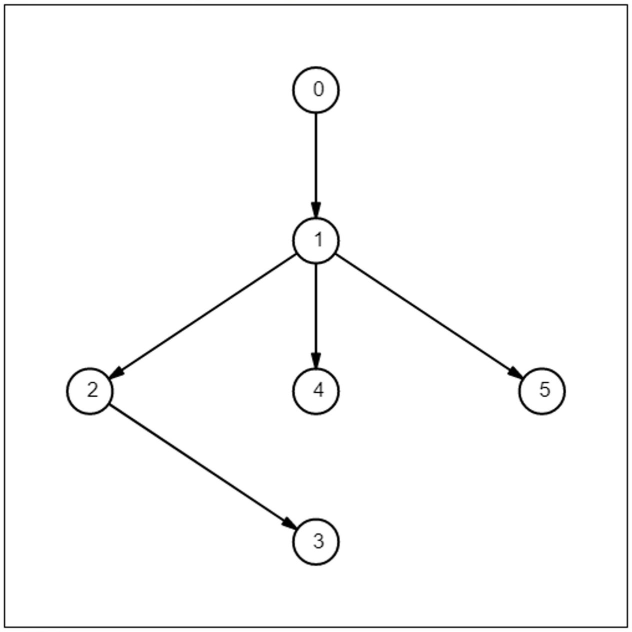
Question 8

• [3 points] Consider Iterative Deepening Search on a tree, where the nodes are denoted by numbers. Write down the sequence IDS visited in the order they are expanded (i.e. expansion path). 0 is the initial state and 5 is the goal state. Start with depth limit 0, include the root, and include repeated nodes.

• Note: use the convention used in the lectures, push the rightmost (in the diagram) successor into the stack first or enqueue the leftmost (in the diagram) successor into the queue first.



0 → 0 → 1 → 0 → 1 → 2

M9Q3-soln

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7 before 3
8 before 2

X4Q15

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Question 15

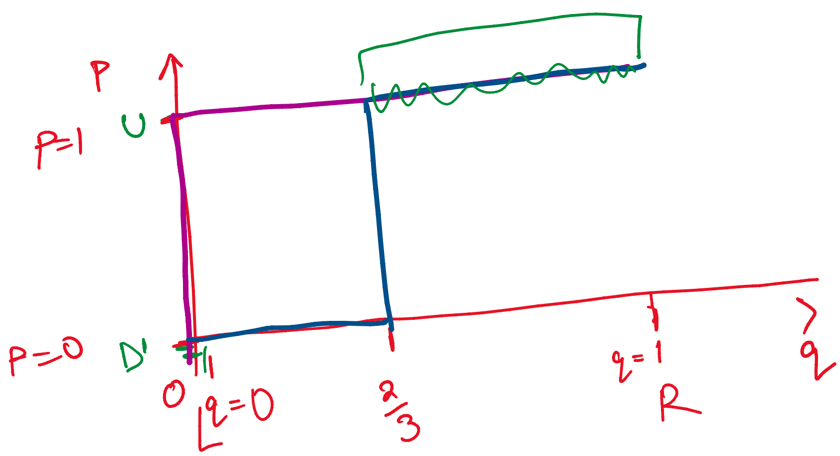
• [4 points] Given the following game payoff table, suppose the the row player uses a pure strategy, and column player uses a mixed strategy playing L with probability q. What is the smallest and largest value of q in a mixed strategy Nash equilibrium?

Row \ Col	L (q)	R (1-q)
U (p)	5, 9	0, 9
D (1-p)	0, 9	10, 0

$5q \geq 10 - 10q \Rightarrow q \geq 2/3$

Best Resp. (row) =
- U → $5q + 0\cdot(1-q) \geq 0q + 10(1-q)$
- mix → $5q = 10(1-q)$
- D → $5q \leq 10(1-q)$, $q \leq 2/3$

B.R. (col) =
- L → $9p + 9(1-p) \geq 9p + 0\cdot(1-p)$
- mix → $9 = 9p \Rightarrow p = 1$
- R → $9 \leq 9p$



X7Q1

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Question 1

• [3 points] Given the variance matrix $\hat{\Sigma}$ is a diagonal matrix, what is the smallest value of K so that the Manhattan distance between the vector $\begin{bmatrix} 1 \\ 1 \\ \cdots \\ 1 \end{bmatrix}$ with 38 1's and its reconstruction using the first K principal components is less than or equal to 8?

• Answer: [ ] Calculate

$K \rightarrow 1's$

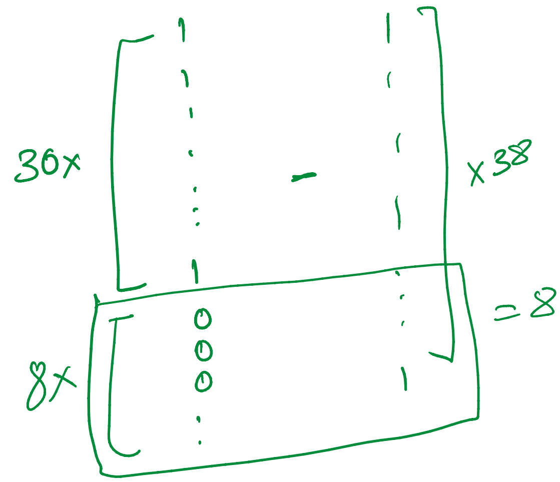
$v_2' = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

$|x_1 - x_2| + |y_1 - y_2| + \cdots$

$v_k' = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix} \leftarrow k$

$38 - k \leq 8$

$k = 30$



X7Q2

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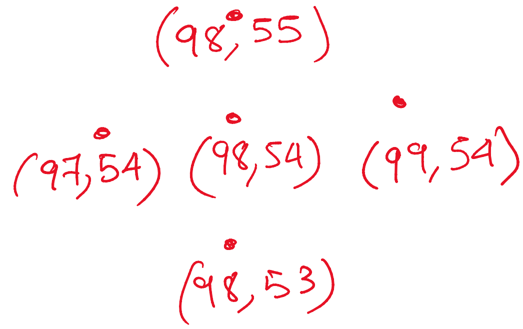
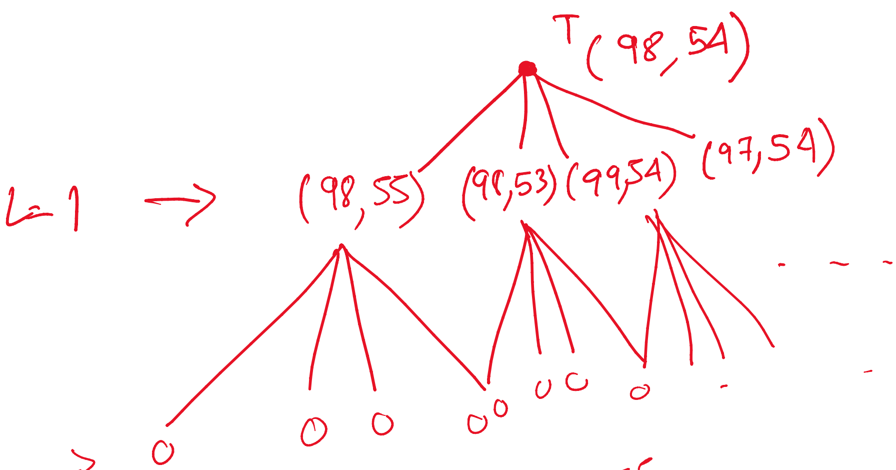
Question 2 ?

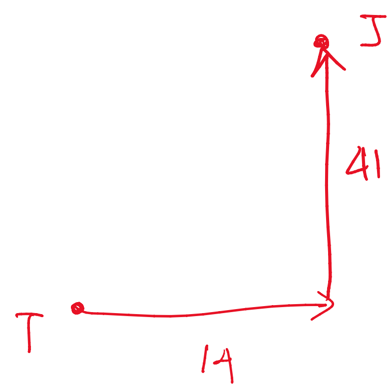
• [3 points] In a 200 by 140 grid, Tom is located at $(98, 54)$ and Jerry is located at $(112, 95)$. Tom uses BFS (Breadth First Search) to find Jerry and the successors of a state (one cell in the grid) are the four neighboring states on the grid (the cells above, below, to the left and to the right). What is the minimum number of states that need to be expanded to find (and expand) the goal state? The order in which the successors are added can be arbitrary. Include both the initial and the goal states.

• Answer: [ ] [Calculate]





$d = 14 + 41 = 55$



$S = 4^{55} + 1$

X7Q3

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Question 3

• [3 points] There are n = 101 students in CS540, for simplificity, assume student 0 gets grade $g = 0$, student 1 gets grade $g = 1$, ..., student $n - 1$ gets grade $g = n - 1$. The payoff for each student who drop the course is 0, the payoff for the students who stay is 0.02 g $- 1.5$ if the student has the lowest grade among all students who decide to stay in the class, and the 0.02 g $- 1$ otherwise. If each student only uses actions that are rationalizable (i.e. survive the iterated elimination of strictly dominated actions), how many students will stay in the course? If there are multiple correct answers, enter one of them.

• Answer: [ ] . Calculate

P(drop) = 0

P(stay and lowest) → $0.02g - 1.5$

P(stay ! lowest) → $0.02g - 1 \leq 0$

$g \leq 50$

$g \leq 50$,

P: $0.02g - 1 \leq 0$

Student who got 50 or less drop.

n_{51} will drop.

52 " "

$0.02g - 1.5 \leq 0$

$g \leq 75$

... > 75 ..... 101 => 26 7

$n \longrightarrow 75 \ldots 101 \Rightarrow 26$

$n \longrightarrow 76 \ldots 101 \Rightarrow 25$]

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