

# National University of Computer and Emerging Sciences, Lahore Campus



Course Name:	Artificial Intelligence	Course Code:	AI2022
Program:	BS (Computer Science)	Semester:	Spring 2022
Duration:	180 Minutes	Total Marks:	90
Paper Date:	7-06-2022	Weight	45%
Section:	All	Page(s):	9
Exam Type:	Final		

Student Name: \_\_\_\_\_

Section: \_\_\_\_\_

Registration #: \_\_\_\_\_

**Instructions:** You might use rough sheets to work out your answers but the final answers must be written in the space provided on this question paper.

## [Question 1] [Search Algorithms]

[8 + 4 + 8 Points]

**Part a)** For the following state-space-search (Graph), use A\* algorithm to find a path from the start node (S) to the goal node (G). Clearly specify the order in which the nodes are expanded and the nodes in the Queue when the goal is found.

<b>GRAPH</b> 	<b>Heuristic</b> <table> <thead> <tr> <th>NODE</th><th>h(NODE)</th></tr> </thead> <tbody> <tr><td>S</td><td>6</td></tr> <tr><td>A</td><td>4</td></tr> <tr><td>B</td><td>1</td></tr> <tr><td>C</td><td>2</td></tr> <tr><td>D</td><td>10</td></tr> <tr><td>E</td><td>20</td></tr> <tr><td>G</td><td>0</td></tr> </tbody> </table>	NODE	h(NODE)	S	6	A	4	B	1	C	2	D	10	E	20	G	0
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<b>SOLUTION</b> <b>SHOW A TREE OR A QUEUE</b>																	

**Part b)** Is the heuristic function given above consistent? Justify

**Part c)** Without running the algorithm, give the path returned by each of the following algorithms for the state-space search problem given below. Also give a brief justification of your answer.

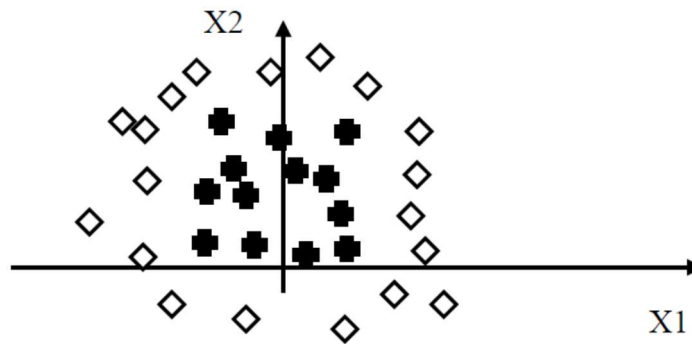
i. BFS (Breadth First Search)

ii. Uniform Cost search

iii. Iterative Deepening

**[Question 4] [Genetic Algorithms]****[5 + 5 + 5 Points]**

Is the following data linearly separable? Give a brief justification. In this dataset filled stars represent the positive class and squares represent negative class.



Suppose that we want to use a function of the form  $f(\mathbf{x}_1, \mathbf{x}_2) = \text{sign}(\mathbf{w}_0 + \mathbf{w}_1 * X_1 + \mathbf{w}_2 * X_2)$  to classify any point into one of the two categories. To find a suitable vector  $\mathbf{W} = [\mathbf{w}_0, \mathbf{w}_1, \mathbf{w}_2]$  we have the above training data. A teacher at FAST suggested to use Genetic Algorithm (GA) for finding a suitable vector  $\mathbf{W}$ .

**Part a)** Describe a suitable chromosome representation for finding a good value of vector  $\mathbf{W}$ .

**Part b)** How would you estimate fitness of a chromosome for this problem?

**Part c)** Explain the difference between single-point crossover and uniform crossover.