Indian Institute of Technology, Madras - BS in Data Science and Applications

Notations :

1.Options shown in green color and with ✔ icon are correct.

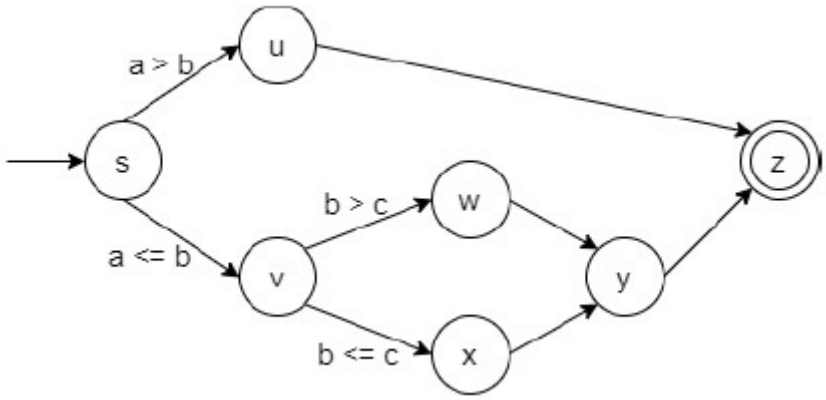
2.Options shown in red color and with ✖ icon are incorrect.

Question Paper Name :	IIT M DEGREE AN2 EXAM QPE2 16 JULY 2023
Subject Name :	2023 July: IIT M DEGREE AN2 EXAM QPE2
Creation Date :	2023-07-10 17:54:46
Duration :	120
Total Marks :	575
Display Marks:	Yes
Share Answer Key With Delivery Engine :	Yes
Actual Answer Key :	Yes
Calculator :	Scientific
Magnifying Glass Required? :	No
Ruler Required? :	No
Eraser Required? :	No
Scratch Pad Required? :	No
Rough Sketch/Notepad Required? :	No
Protractor Required? :	No
Show Watermark on Console? :	Yes
Highlighter :	No
Auto Save on Console?	Yes
Change Font Color :	No
Change Background Color :	No

Correct Marks : 4 Max. Selectable Options : 0

Question Label : Multiple Select Question

Consider the annotated CFG given below.



Identify the test case input(s) that test the path [s, v, x, y, z].

Options :

6406531932768. ✖ {a = 10, b = 20, c = 15}

6406531932769. ✔ {a = 10, b = 20, c = 30}

6406531932770. ✖ {a = 30, b = 20, c = 30}

6406531932771. ✔ {a = 30, b = 30, c = 30}

AI

Section Id :	64065339126
Section Number :	2
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	5
Number of Questions to be attempted :	5
Section Marks :	25
Display Number Panel :	Yes
Group All Questions :	No

Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	64065382928
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Number : 19 Question Id : 640653578837 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 0

Question Label : Multiple Choice Question

THIS IS QUESTION PAPER FOR THE SUBJECT "DEGREE LEVEL : AI: SEARCH METHODS FOR PROBLEM SOLVING (COMPUTER BASED EXAM)"

ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?

CROSS CHECK YOUR HALL TICKET TO CONFIRM THE SUBJECTS TO BE WRITTEN.

(IF IT IS NOT THE CORRECT SUBJECT, PLS CHECK THE SECTION AT THE TOP FOR THE SUBJECTS REGISTERED BY YOU)

Options :

6406531932780. ✔ YES

6406531932781. ✖ NO

Sub-Section Number :	2
Sub-Section Id :	64065382929
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653578838 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix

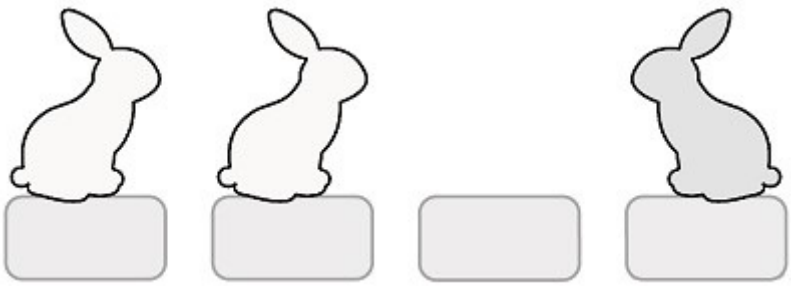
Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (20 to 22)

Question Label : Comprehension

STATE SPACE

Recall the rabbits crossing puzzle from the practice assignment. Two groups of rabbits, each group at opposite ends of a path, want to cross the path by making only forward jumps: a rabbit can jump forward to an adjacent empty spot, or jump forward over one rabbit and land in an empty spot.



The start state is **(RR-L)** , where **R** is a rabbit that wants to go right, and **L** is a rabbit that wants to go left, and the dash marks the empty spot.

Construct all the states that are reachable from the start state and build a state space graph out of those states, call it Graph-21.

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 20 Question Id : 640653578839 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following states are reachable from the start state in exactly 3 moves?

Options :

6406531932782. ✔ (RL–R)

6406531932783. ✔ (–RLR)

6406531932784. ✖ (–RRL)

6406531932785. ✖ (–LRR)

6406531932786. ✖ (L–RR)

Question Number : 21 Question Id : 640653578840 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

From (RR-L) , the minimum number of moves needed to reach (L-RR) is _____

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

5

Question Number : 22 Question Id : 640653578841 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Max. Selectable Options : 0

Question Label : Multiple Select Question

For Graph-21, when there is a path from some start state to some goal state, _____ .

Options :

6406531932788. ✖ Depth First Search can find a solution only if the first move chosen is part of the final solution

6406531932789. ✔ Depth First Search can find a solution even if the first move chosen is not part of the final solution

6406531932790. ✖ Breadth First Search can find a solution only if the first move chosen is part of the final solution

6406531932791. ✔ Breadth First Search can find a solution even if the first move chosen is not part of the final solution

Sub-Section Number :	3
Sub-Section Id :	64065382930
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653578842 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (23 to 30)

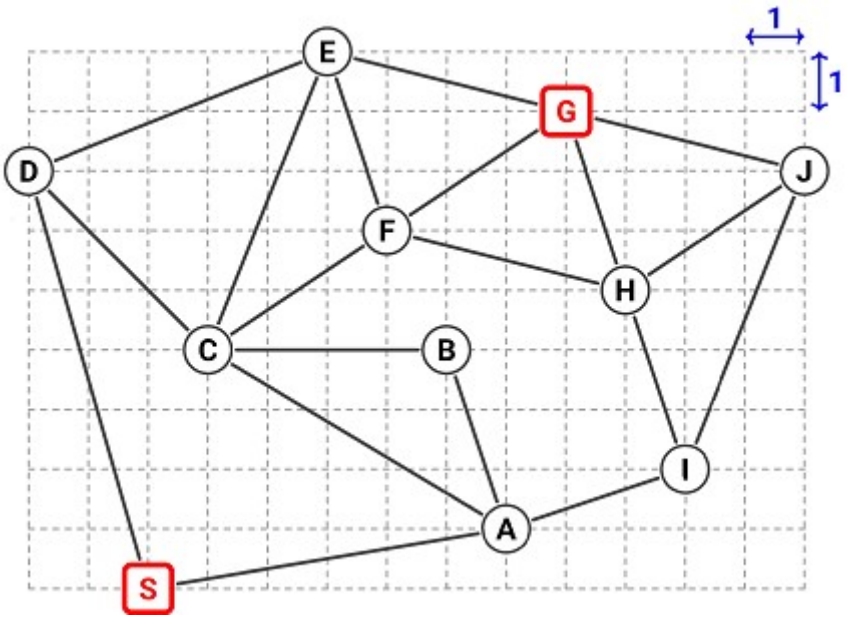
Question Label : Comprehension

SEARCH

The figure shows a map with several locations on a grid where each tile is 1x1 in size. The locations are at grid points and are connected by two-way edges.

Take S as the start node and G as the goal node. The MoveGen function returns neighbours in alphabetical order. In all the algorithms below, the RemoveSeen procedure will remove nodes from the output of MoveGen if those nodes are present in OPEN/CLOSED lists.

Use Manhattan distance when needed.



When we say a node is inspected/expanded/refined it means: the node is picked up from OPEN, and goal test is called, if goal test fails then MoveGen is called and, depending on the algorithm, the neighbours are selectively placed in OPEN.

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 23 Question Id : 640653578843 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

List the first 4 nodes (including the start node) inspected by Depth First Search. List the nodes in the order they were inspected. If the algorithm terminates early then list the nodes inspected up until termination.

Enter a comma separated list of node labels.
NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS

Answer Format: S,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,A,B,C

Question Number : 24 Question Id : 640653578844 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

What is the path found by Depth First Search?

Enter the path as a comma separated list of node labels.

Enter NIL if no path is found.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,G

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,A,C,E,G

Question Number : 25 Question Id : 640653578845 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

List the first 4 nodes inspected by Breadth First Search. List the nodes in the order they were

inspected. If the algorithm terminates early then list the nodes inspected up until termination.

Enter a comma separated list of node labels.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,A,D,B

Question Number : 26 Question Id : 640653578846 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

What is the path found by Breadth First Search?

Enter the path as a comma separated list of node labels.

Enter NIL if no path is found.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,G

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,D,E,G

Question Number : 27 Question Id : 640653578847 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

List the first 4 nodes inspected by Best First Search. List the nodes in the order they were inspected. If the algorithm terminates early then list the nodes inspected up until termination.

Enter a comma separated list of node labels.
NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,A,B,I

Question Number : 28 Question Id : 640653578848 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

What is the path found by Best First Search?

Enter the path as a comma separated list of node labels.

Enter NIL if no path is found.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,G

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,A,I,H,G

Question Number : 29 Question Id : 640653578849 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

List the first 4 nodes inspected by Hill Climbing. List the nodes in the order they were inspected. If the algorithm terminates early then list the nodes inspected up until termination.

Enter a comma separated list of node labels.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

S,A,B

Question Number : 30 Question Id : 640653578850 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

What is the path found by Hill Climbing?

Enter the path as a comma separated list of node labels.

Enter NIL if no path is found.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer Format: S,X,Y,G

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

Nil

Sub-Section Number :	4
Sub-Section Id :	64065382931
Question Shuffling Allowed :	No
Is Section Default? :	null

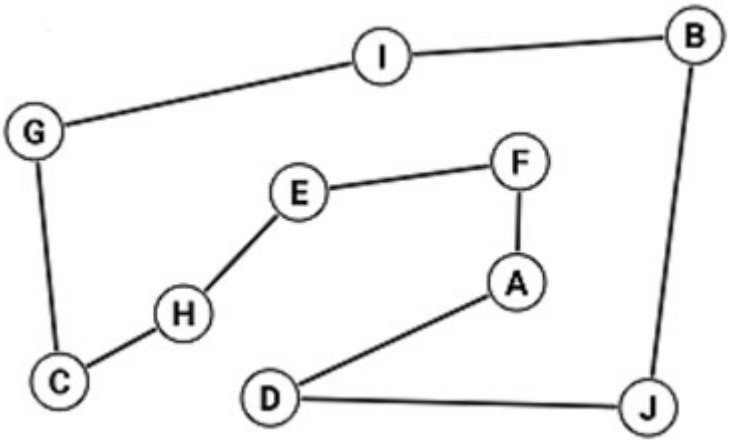
Question Id : 640653578851 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (31 to 34)

Question Label : Comprehension

Genetic Algorithm

A tour of 10 cities is shown below. The edges are bi-directional. Use A,B,C,...,H,I,J as the reference (index) sequence to prepare tour representations.



Based on the above data, answer the given subquestions.

Sub questions

Question Number : 31 Question Id : 640653578852 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Max. Selectable Options : 0

Question Label : Multiple Select Question

Select all valid path representations of the tour.

Options :

6406531932800. ✖ B,I,G,C,H,E,F,A,D,J,B

6406531932801. ✖ A,F,E,H,C,G,I,B,J,D,A

6406531932802. ✔ B,I,G,C,H,E,F,A,D,J

6406531932803. ✔ A,F,E,H,C,G,I,B,J,D

Question Number : 32 Question Id : 640653578853 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction

Time : 0

Correct Marks : 1 Max. Selectable Options : 0

Question Label : Multiple Select Question

Select all valid adjacency representations of the tour.

Options :

6406531932804. ✔ D,I,H,J,F,A,C,E,G,B

6406531932805. ✔ F,J,G,A,H,E,I,C,B,D

6406531932806. ✖ D,I,H,J,A,E,C,F,G,B

6406531932807. ✖ E,J,G,A,F,H,I,C,B,D

Question Number : 33 Question Id : 640653578854 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Multiple Choice Question

Convert the path representation C,E,F,D,G,A,H,J,B,I to ordinal representation.

Options :

6406531932808. ✔ 3,4,4,3,3,1,2,3,1,1

6406531932809. ✖ 2,8,6,2,5,3,3,1,1,1

6406531932810. ✖ 2,8,6,2,5,4,3,1,1,1

6406531932811. ✖ 9,5,1,5,1,2,3,1,2,1

Question Number : 34 Question Id : 640653578855 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

Two tours in path representation are given below. Generate offspring using Partially Mapped Crossover (PMX), use the locations from 4 to 7 (both inclusive) as the mapping segment. Enter any one of the two child tours in the textbox.

P1: B,I,G,C,H,E,F,A,D,J

P2: C,E,F,D,G,A,H,J,B,I

Enter a comma separated list of cities. DO NOT ENTER SPACES, TABS, DOTS, BRACKETS OR EXTRANEOUS CHARACTERS.

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Set

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

D,A,G,C,H,E,F,J,B,I

B,I,F,D,G,A,H,E,C,J

Sub-Section Number :	5
Sub-Section Id :	64065382932
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653578856 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (35 to 39)

Question Label : Comprehension

TSP

The distance matrix for 5 cities and the corresponding edge costs (in sorted order) are provided below. Use this information to construct TSP tours.

	A	B	C	D	E
A	-	98	55	96	54
B	98	-	63	50	87
C	55	63	-	30	68
D	96	50	30	-	47
E	54	87	68	47	-

CD	DE	BD	AE	AC
30	47	50	54	55

BC	CE	BE	AD	AB
63	68	87	96	98

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 35 Question Id : 640653578857 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

Use B as the starting city, construct a tour using Nearest Neighbour Heuristic. The tour is _____ . Enter the path representation of the tour, start from B and trace the cities selected by the Nearest Neighbour Heuristic.

Enter a comma separated list of city names.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer format: B,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

B,D,C,A,E

Question Number : 36 Question Id : 640653578858 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

What is the cost of the tour generated by Nearest Neighbour Heuristic?

Enter a number.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer format: 17

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

276

Question Number : 37 Question Id : 640653578859 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

Construct a tour using Greedy Heuristic. Enter the path representation of the tour starting from city B.

Enter a comma separated list of city names.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer format: B,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Set

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

B,C,D,E,A

B,A,E,D,C

Question Number : 38 Question Id : 640653578860 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

What is the cost of the tour generated by Greedy Heuristic?

Enter a number.

NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.

Answer format: 17

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

292

Question Number : 39 Question Id : 640653578861 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

Construct the savings tour using B as the base city. The savings for including the pairs of cities CD, CE and DE are 83, 82 and 90, respectively. Compute the savings for the remaining three pairs of cities, and use them to simulate the algorithm. Enter the path representation of the tour starting from city B.

Enter a comma separated list of city names.
NO SPACES, TABS, DOTS, BRACKETS, PARENTHESIS OR UNWANTED CHARACTERS.
Answer format: B,X,Y,Z

Response Type : Alphanumeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Set

Answers Case Sensitive : No

Text Areas : PlainText

Possible Answers :

B,C,A,E,D

B,D,E,A,C

Deep Learning

Section Id :	64065339127
Section Number :	3
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	9
Number of Questions to be attempted :	9
Section Marks :	50