

Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	750
Is this Group for Examiner? :	No
Examiner permission :	Cant View
Show Progress Bar? :	No
Revisit allowed for group Instructions? :	Yes
Maximum Instruction Time :	0
Minimum Instruction Time :	0
Group Time In :	Minutes
Revisit Section :	Yes
Action on Revisit Section :	View and Edit
Navigate To Group Summary From Last Question? :	No
Disable Submit Button During Assessment? :	No
Section Selection Time? :	0
No of Optional sections to be attempted :	0

## AI

Section Id :	64065394329
Section Number :	1
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
Section Negative Marks :	0
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	No
Section Maximum Duration :	0
Section Minimum Duration :	0
Section Time In :	Minutes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	640653213911
Question Shuffling Allowed :	No

Question Number : 1 Question Id : 6406531323133 Question Type : MCQ

**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 :**

6406534432023.  YES

6406534432024.  NO

**Sub-Section Number :** 2

**Sub-Section Id :** 640653213912

**Question Shuffling Allowed :** No

**Question Id : 6406531323134 Question Type : COMPREHENSION Sub Question Shuffling**

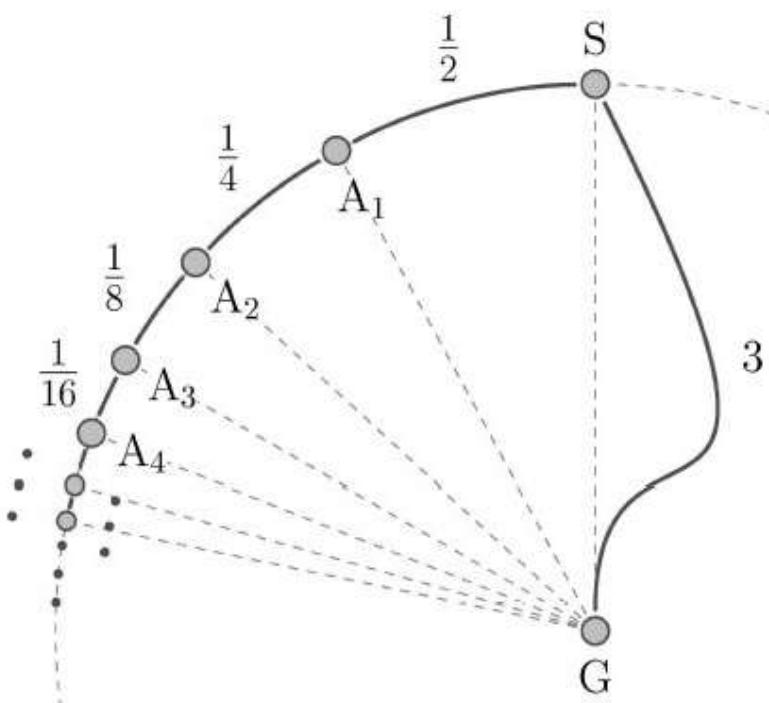
**Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix**

**Question Numbers : (2 to 7)**

Question Label : Comprehension

**SEARCH**

Figure shows an infinite state space with finite branching, where S is the start node and G is the goal node, and G is at the center of a unit circle, and the remaining nodes are on the unit circle. (Note: circular grid is shown by dashed lines which are not part of the state space.)



Take the radial distance as the heuristic value:  
 $h(G)=0$ ;  $h(S)=1$ ; and  $h(A_k)=k$ , for all  $k \in \{1, 2, \dots\}$ .

MoveGen returns neighbours in alphabetical order ( $A_1, A_2, \dots, G, S$ ).

**Tie-breaker:** use alphabetical order to break ties.

**Note:**  $\sum(1, a, a^2, a^3, \dots, a^{n-1})$  is given by  $((1 - a^n)/(1 - a))$ .

Based on the above data, answer the given subquestions

### Sub questions

#### Question Number : 2 Question Id : 6406531323135 Question Type : MCQ

**Correct Marks : 1**

Question Label : Multiple Choice Question

Does the Breadth First Search find the path to the goal?

**Options :**

6406534432025. Yes

6406534432026. No

6406534432027. Cannot be determined

#### Question Number : 3 Question Id : 6406531323136 Question Type : MCQ

**Correct Marks : 1**

Question Label : Multiple Choice Question

Does the Best First Search find the path to the goal?

**Options :**

6406534432028. Yes

6406534432029. No

6406534432030. Cannot be determined

#### Question Number : 4 Question Id : 6406531323137 Question Type : MCQ

**Correct Marks : 1**

Question Label : Multiple Choice Question

Does the Branch and Bound algorithm find the path to the goal?

**Options :**

6406534432031. Yes

6406534432032. No

6406534432033. Cannot be determined

#### Question Number : 5 Question Id : 6406531323138 Question Type : MCQ

**Correct Marks : 1**

Question Label : Multiple Choice Question

Does A\* algorithm find the path to the goal?

**Options :**

6406534432034. ✅ Yes

6406534432035. ✅ No

6406534432036. ✖ Cannot be determined

**Question Number : 6 Question Id : 6406531323139 Question Type : MCQ**

**Correct Marks : 1**

Question Label : Multiple Choice Question

Does wA\* (w=3) algorithm find the path to the goal?

**Options :**

6406534432037. ✅ Yes

6406534432038. ✖ No

6406534432039. ✖ Cannot be determined

**Question Number : 7 Question Id : 6406531323140 Question Type : MCQ**

**Correct Marks : 1**

Question Label : Multiple Choice Question

Is the heuristic admissible in the given state space?

**Options :**

6406534432040. ✅ Yes

6406534432041. ✖ No

6406534432042. ✖ Cannot be determined

**Sub-Section Number :**

3

**Sub-Section Id :**

640653213913

**Question Shuffling Allowed :**

No

**Question Id : 6406531323141 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix**

**Question Numbers : (8 to 12)**

Question Label : Comprehension

**TSP**

The distance matrix for 5 cities (A to E) and the sorted edge list is provided below.

For each city the distances to other cities are listed in ascending order.

For example, in row one, the distance from A to B is 30, A to C is 32 and so on.

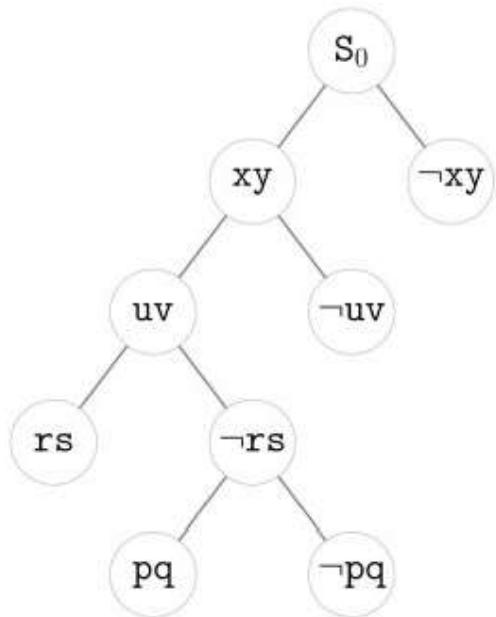
A	B:30	C:32	D:68	E:70
B	A:30	C:36	E:40	D:44
C	A:32	B:36	D:50	E:72
D	E:42	B:44	C:50	A:68
E	B:40	D:42	A:70	C:72

AB	AC	BC	BE	DE
30	32	36	40	42

BD	CD	AD	AE	CE
44	50	68	70	72

The search tree traversed by TSP BnB shows four segments.

Identify the four segments  $xy$ ,  $uv$ ,  $rs$ ,  $pq$  and then answer the given sub-questions.



**Attention:** A segment is a two-way edge between two cities. After adding/dropping a permanent segment, infer as many new permanent segments as possible before computing the lower bound.

### Sub questions

**Question Number : 8 Question Id : 6406531323142 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

What is the lower bound on the cost of the tour as per the TSP BnB algorithm discussed in class?

Enter a natural number.

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEous CHARACTERS.

Answer format: 17

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

182

**Question Number : 9 Question Id : 6406531323143 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

What is the first segment (XY) selected for refining S0?

Enter edge label XY

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEous CHARACTERS.

Answer format: XY

**Response Type :** Alphanumeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Set

**Answers Case Sensitive :** No

**Text Areas :** PlainText

**Possible Answers :**

AB

BA

**Question Number : 10 Question Id : 6406531323144 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

What is the cost of the node ~XY (that  
permanently excludes segment XY)?

Enter a natural number.

NO SPACES, TABS, DOTS, BRACKETS OR  
EXTRANEous CHARACTERS.

Answer format: 42

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

206

**Question Number : 11 Question Id : 6406531323145 Question Type : SA****Correct Marks : 1**

Question Label : Short Answer Question

How many tours are represented in the node rs?

Enter a natural number.

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEous CHARACTERS.

Answer format: 42

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

0

**Question Number : 12 Question Id : 6406531323146 Question Type : SA****Correct Marks : 1**

Question Label : Short Answer Question

What is the cost of the node ~pq (that permanently excludes segment pq)?

Enter a natural number.

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEous CHARACTERS.

Answer format: 17

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

320

**Sub-Section Number :** 4

**Sub-Section Id :** 640653213914

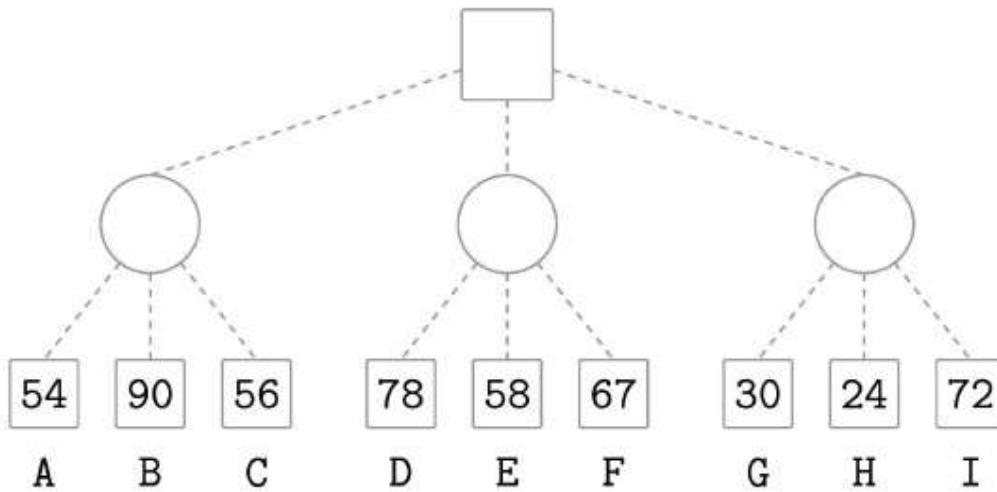
**Question Shuffling Allowed :** No

**Question Id : 6406531323147 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix**

**Question Numbers : (13 to 19)**

Question Label : Comprehension

## GAMES



Based on the above data, answer the given subquestions

### Sub questions

**Question Number : 13 Question Id : 6406531323148 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

List the horizon nodes in the best strategy.

Enter the node labels as a comma separated list in ASCENDING order.

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEOUS CHARACTERS.

Answer format: 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 :**

D,E,F

**Question Number : 14 Question Id : 6406531323149 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

List the horizon nodes pruned by Alpha-Beta algorithm.

Enter the node labels as a comma separated list in ASCENDING order.

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEOUS CHARACTERS.

Answer format: 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 :**

H,I

**Question Number : 15 Question Id : 6406531323150 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

List the horizon nodes in the initial cluster formed by SSS\* algorithm.

Enter the node labels as a comma separated list in ASCENDING order.

NO SPACES, TABS, DOTS, BRACKETS  
OR EXTRANEous CHARACTERS.

Answer format: 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 :**

A,D,G

**Question Number : 16 Question Id : 6406531323151 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

Solve the game tree using SSS\* algorithm.

List the horizon nodes (not in the initial cluster) that are assigned SOLVED status.

Enter the node labels as a comma separated list in ASCENDING order.

NO SPACES, TABS, DOTS, BRACKETS OR  
EXTRANEous CHARACTERS.

Answer format: 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 :**

E,F

**Question Number : 17 Question Id : 6406531323152 Question Type : MSQ**

**Correct Marks : 1 Max. Selectable Options : 0**

Question Label : Multiple Select Question

Select the correct statements about the Alpha-Beta algorithm.

**Options :**

6406534432052. ✓ Alpha-Cut prunes MAX nodes.

6406534432053. ✓ Alpha-Cut is made by a MIN node.

6406534432054. ✓ Beta-Cut prunes MIN nodes.

6406534432055. ✓ Beta-Cut is made by a MAX node.

**Question Number : 18 Question Id : 6406531323153 Question Type : MCQ**

**Correct Marks : 1**

Question Label : Multiple Choice Question

Select the condition that triggers an Alpha-Cut.

**Options :**

6406534432056. ✓ eval(child) <= Alpha

6406534432057. ✘ Alpha < eval(child) < Beta

6406534432058. ✘ Beta <= eval(child)

6406534432059. ✘ Cannot be determined

**Question Number : 19 Question Id : 6406531323154 Question Type : MCQ**

**Correct Marks : 1**

Question Label : Multiple Choice Question

For a 2-ply game tree with branching factor 3, the number of strategies for MAX-player is \_\_\_\_\_.

**Options :**

6406534432060. ✘ 2

6406534432061. ✓ 3

6406534432062. ✘  $2^2$

6406534432063. ✘  $2^3$

6406534432064. ✘  $3^2$

6406534432065. ✘  $3^3$

**Sub-Section Number :** 5  
**Sub-Section Id :** 640653213915  
**Question Shuffling Allowed :** No

**Question Id : 6406531323155 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix**

**Question Numbers : (20 to 26)**

Question Label : Comprehension

## AUTOMATED PLANNING

The domain description of a Blocks World with a single one-armed robot is given below.

**Note:** this is the same domain description used in the weekly assignments.

### PREDICATES

armEmpty	The arm is not holding any block, it is empty.
holding(X)	The arm is holding X.
onTable(X)	X is on the table.
clear(X)	X has nothing above it, it is clear.
on(X,Y)	X is directly placed on Y.

### OPERATORS

**Pickup(X):** pick up X from the table.

Preconditions: { armEmpty, clear(X), onTable(X) }  
Add Effects : { holding(X) }  
Del Effects : { armEmpty, onTable(X) }

**Putdown(X):** place X on the table.

Preconditions: { holding(X) }  
Add Effects : { armEmpty, onTable(X) }  
Del Effects : { holding(X) }

**Unstack(X,Y):** pick up X that is directly sitting on Y.

Preconditions: { armEmpty, clear(X), on(X,Y) }  
Add Effects : { clear(Y), holding(X) }  
Del Effects : { armempty, on(X,Y) }

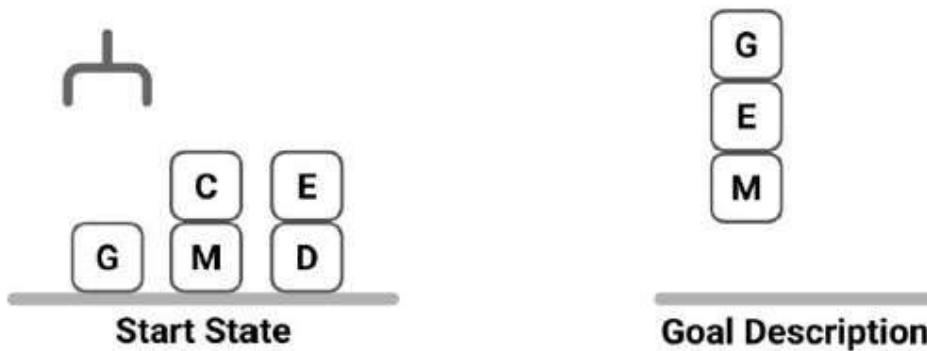
**Stack(X,Y):** place X directly on top of Y.

Preconditions: { holding(X), clear(Y) }  
Add Effects : { armEmpty, on(X,Y) }  
Del Effects : { holding(X), clear(Y) }

**Tie-breaker:** When actions are chosen non-deterministically, choose actions that lead to a plan. Throw away the actions that lead to dead-ends or cycles.

**Tie-breaker:** Treat the goal description, preconditions and effects as lists that are accessed from left to right. When the elements in a list are pushed one by one to a stack, the last element in the list will be at the top of the stack. It has the effect of reversing the list.

A planning problem is given below, find a plan using the operators and predicates defined in the blocks-world domain.



Start: { armEmpty, onTable(G), onTable(M), onTable(D),  
clear(G), clear(C), clear(E), on(C,M), on(E,D) }

Goal Description: { on(E,M), on(G,E) }

Based on the above data, answer the given subquestions

**Sub questions**

**Question Number : 20 Question Id : 6406531323156 Question Type : SA**

**Correct Marks : 1**

Question Label : Short Answer Question

What is the length of the optimal plan? Enter the number of actions in the optimal plan.

NO SPACES, TABS, DOTS, BRACKETS OR EXTRANEous CHARACTERS.

Answer format: 42

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

6

**Question Number : 21 Question Id : 6406531323157 Question Type : MSQ**

**Correct Marks : 1 Max. Selectable Options : 0**

Question Label : Multiple Select Question

Which of the following are **applicable** actions for the given planning problem?

**Options :**

6406534432067. ❌ Pickup(D)

6406534432068. ✓ Pickup(G)

6406534432069. ❌ Pickup(M)

6406534432070. ✓ Unstack(C,M)

6406534432071. ✓ Unstack(E,D)

**Question Number : 22 Question Id : 6406531323158 Question Type : MSQ****Correct Marks : 1 Max. Selectable Options : 0**

Question Label : Multiple Select Question

Which of the following are **relevant** actions for the given planning problem?

**Options :**

6406534432072. ❌ Pickup(G)

6406534432073. ✓ Stack(E,M)

6406534432074. ✓ Stack(G,E)

6406534432075. ❌ Unstack(C,M)

6406534432076. ❌ Unstack(E,D)

**Question Number : 23 Question Id : 6406531323159 Question Type : MCQ****Correct Marks : 1**

Question Label : Multiple Choice Question

Which of the following can be pushed as the first three elements onto the stack by the Goal Stack Planning algorithm? In the representation below the stack has a bottom on the right marked by the entry END. Use appropriate tie-breakers listed in the main data.

**Options :**

6406534432077. ❌ { on(E,M), on(G,E) }; on(E,M); on(G,E); END

6406534432078. ❌ { on(E,M), on(G,E) }; on(G,E); on(E,M); END

6406534432079. ✓ on(G,E); on(E,M); { on(E,M), on(G,E) }; END

6406534432080. ❌ on(E,M); on(G,E); { on(E,M), on(G,E) }; END

**Question Number : 24 Question Id : 6406531323160 Question Type : MCQ****Correct Marks : 1**

Question Label : Multiple Choice Question

For the subgoal ordering given in the goal description (and using the given tie breaking rules), which of the following is the first action popped out of the stack in Goal Stack Planning?

**Options :**

6406534432081. ✓ Pickup(G)

6406534432082. ❌ Stack(G,E)

6406534432083. ✘ Unstack(E,D)

6406534432084. ✘ Unstack(C,M)

**Question Number : 25 Question Id : 6406531323161 Question Type : MCQ**

**Correct Marks : 1**

Question Label : Multiple Choice Question

For the subgoal ordering given in the goal description (and using the given tie breaking rules), does the Goal Stack Planning algorithm find an optimal plan?

**Options :**

6406534432085. ✘ Yes

6406534432086. ✓ No

6406534432087. ✘ Cannot be determined

**Question Number : 26 Question Id : 6406531323162 Question Type : MCQ**

**Correct Marks : 1**

Question Label : Multiple Choice Question

If the subgoals in the goal description are swapped places then does the Goal Stack Planning algorithm find an optimal plan?

**Options :**

6406534432088. ✓ Yes

6406534432089. ✘ No

6406534432090. ✘ Cannot be determined

## PDSA

<b>Section Id :</b>	64065394330
<b>Section Number :</b>	2
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	17
<b>Number of Questions to be attempted :</b>	17
<b>Section Marks :</b>	50
<b>Display Number Panel :</b>	Yes
<b>Section Negative Marks :</b>	0
<b>Group All Questions :</b>	No
<b>Enable Mark as Answered Mark for Review and Clear Response :</b>	No
<b>Section Maximum Duration :</b>	0
<b>Section Minimum Duration :</b>	0
<b>Section Time In :</b>	Minutes
<b>Maximum Instruction Time :</b>	0