4) You are a map-coloring robot assigned to color the South-East regions must be colored a different color (R Red, B Blue, G

KA=
LA=
MA=
MY=
TH=
VI=

a) Draw the constrai
b) Cross out all val
Checking, after vari

c) KA and TH have been assigned values R and G res
been done. Cross out all values that would be elimina

d) Consider the assignment below. TH is assigned and co
unassigned variables that might be selected by the **Minimum-**

KA	LA	MA	MY
G B	G B	G B	G B

e) Consider the same assignment given in (d). List all unassigne
Heuristic.

f) Consider the complete but inconsistent assignment below. M
value during local search for a complete and consistent assignm
MA by the Min-Conflicts Heuristic?

KA	LA	MA	MY
B	G	?	G

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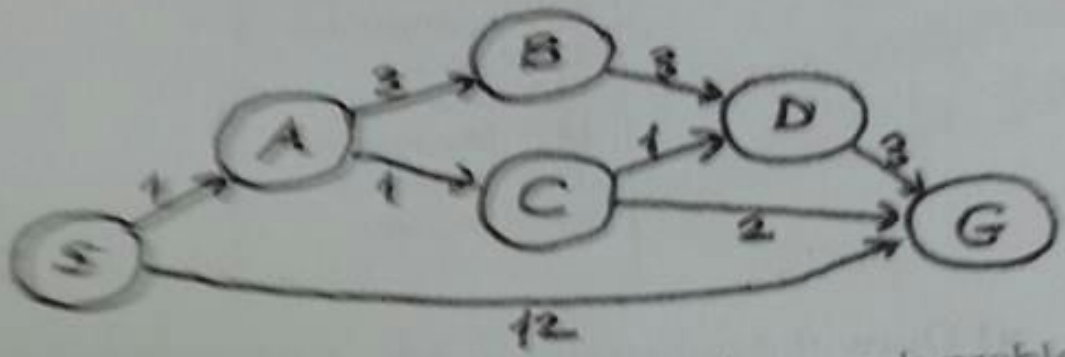


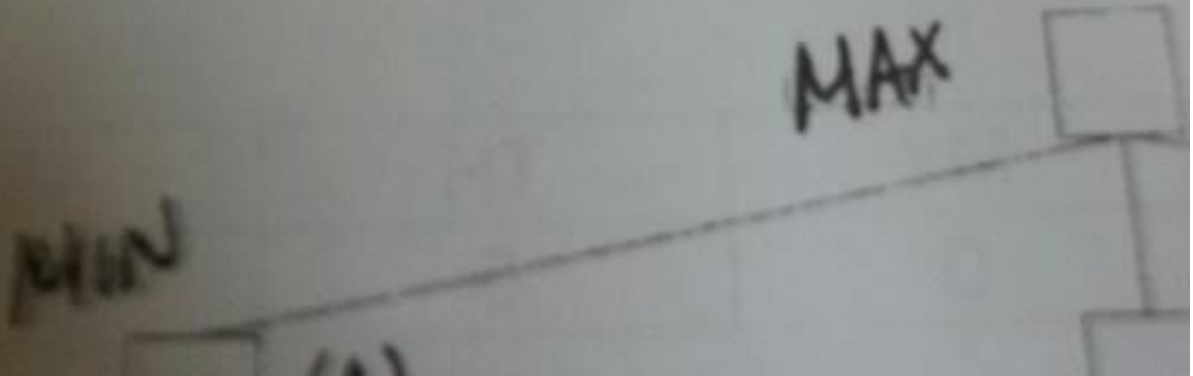
Answer the following questions about the search problem s
alphabetically.

a) What path would A* search, using a consistent heuris
b) Consider the heuristics for this problem shown in the
explain why?

State	h_1	h_2
S	5	4
A	3	2
B	6	6
C	2	1
D	3	3
G	0	0

i) Is h
ii) Is h
iii) Is
iv) Is

2) The game tree below illustrates a position reached in the
turn to move.



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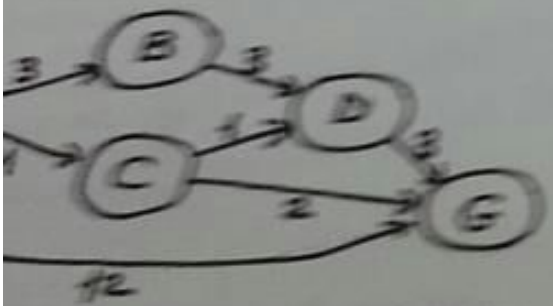
ntelligence and Expert Systems - Final Exam



estions about the search problem shown above. Break any ties

arch, using a consistent heuristic, return for this search problem?

for this problem shown in the table below. Answer the questions below an

	h_1	h_2
	5	4
	3	2
	6	6
	2	1
	3	3
	0	0

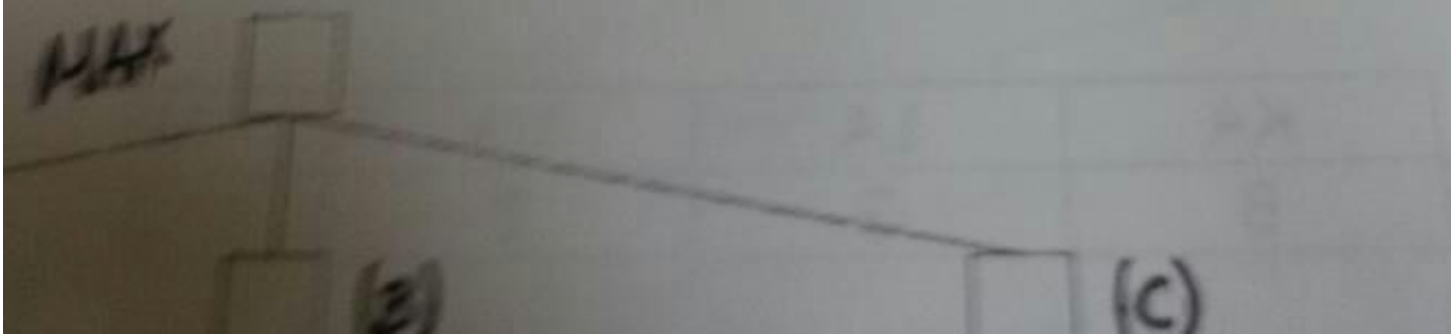
i) Is h_1 admissible?

ii) Is h_1 consistent?

iii) Is h_2 admissible?

iv) Is h_2 consistent?

sition reached in the game. Process the tree left-to-right. It is **Max**'s



c) KA and TH have been assigned values R and G respectively. Then forward checking has been done. Cross out all values that would be eliminated by this forward checking.

d) Consider the assignment below. TH is assigned and forward checking has been done. List all unassigned variables that might be selected by the **Minimum-Remaining-Values Heuristic**.

KA	LA	MA	MY	TH
R				G

e) Consider the same assignment given in (d). List all unassigned variables that might be selected by the **Degree Heuristic**.

f) Consider the complete but inconsistent assignment below. MA has just been selected for a value during local search for a complete and consistent assignment. What new value will be assigned to MA by the Min-Conflicts Heuristic?

KA	LA	MA	MY	TH
B	G	?		

5) (The package delivery robot). Assume this robot knows the following facts:

- All packages in room 5 are smaller than those in room 6.
- Package A is either in room 5 or in room 6.
- Package B is in room 5.
- Package B is not smaller than Package A.

a) Select the appropriate predicates and write the given sentences in FOL.

b) Apply Resolution Rules to prove that Package A is in room 5.

igned to color the South-East Asia map given below. Adjacent
t color (R Red, B Blue, G Green)

KA=Kampuchia LA=Laos MA=Malaysia MY=Myanmar TH=Thailand VI=Vietnam

) Draw the constraint graph of the given map.
) Cross out all values that would be eliminated by **Forward**
hecking, after variable KA has just been assigned value R.

ues R and G respectively, but no constraint propagation has
would be eliminated **by Arc Consisteney**.

gned and constraint propagation has been done. List all
Minimum-Remaining-Values (MRV) Heuristic.

MY	TH	VI
G B	R	R G B

unassigned variables that might be selected by the **Degree**

elow. MA has just been selected to be assigned a new
assignment. What new value would be chosen below for

MY	TH	VI
G	G	B

lues that would be eliminated **by Arc Consistency**.

II is assigned and constraint propagation has been done. List all ted by the ***Minimum-Remaining-Values* (MRV) Heuristic.**

MA	MY	TH	VI
G B	G B	R	R G B

i). List all unassigned variables that might be selected by the **Degree**

signment below. MA has just been selected to be assigned a new consistent assignment. What new value would be chosen below for

	MY	TH	VI
	G	G	B

this robot knows the following facts:
than those in room 6.
room 6.

ge A.

te the given sentences in First Order Logic (FOL).
kage A is in room 5.

T.C.
İSTANBUL ÜNİVERSİTESİ

Name-Surname:
Number:

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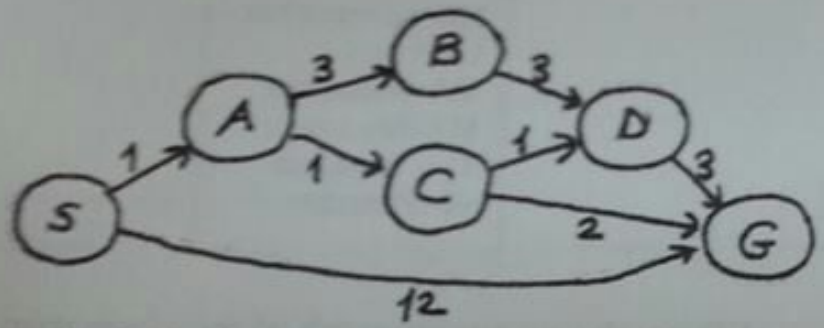
1)



Answer the following questions about the search problem shown above. Break any ties alphabetically.

a) What path would A* search, using a consistent heuristic, return for this search problem?

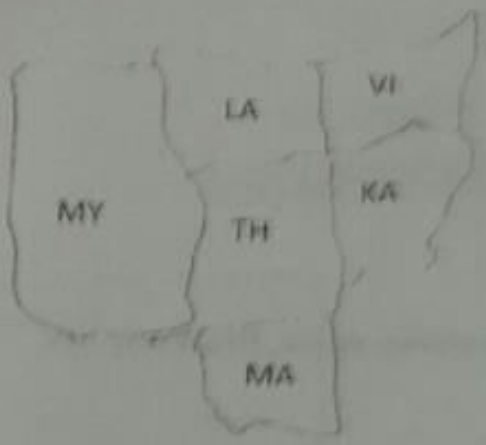
b) Consider the heuristics for this problem shown in the table below. Answer the questions below an explain why?

State	h_1	h_2
S	5	4
A	3	2
B	6	6
C	2	1
D	3	3
G	0	0

i) Is h_1 admissible?
ii) Is h_1 consistent?
iii) Is h_2 admissible?
iv) Is h_2 consistent?

2) The game tree below illustrates a position reached in the game. Process the tree left to right

4) You are a map-coloring robot assigned to color the South-East Asia map given below. Adjacent regions must be colored a different color (R: Red, B: Blue, G: Green).



a) Draw the constraint graph of the given map.
b) Cross out all values that would be eliminated by Forward Checking, after variable KA has just been assigned value G.

c) KA and TH have been assigned values R and G respectively, but no constraint propagation has been done. Cross out all values that would be eliminated by Arc Consistency.

Consider the assignment below. TH is assigned and constraint propagation has been done. Unassigned variables that might be selected by the **Minimum-Remaining-Values (MRV) Heuristic.**

KA	LA	MA	MY	TH	VI
G B	G B	G B	G B	R	R G B

Consider the same assignment given in (d). List all unassigned variables that might be selected by the **Min-Conflicts Heuristic.**

Consider the complete but inconsistent assignment below. MA has just been selected to be assigned a value during local search for a complete and consistent assignment. What new value would be chosen by the Min-Conflicts Heuristic?

KA	LA	MA	MY	TH	VI
B	G	?	G	G	B

5) (The package delivery robot). Assume this robot knows the following facts.

All packages in room 5 are smaller than those in room 6.

Package A is either in room 5 or in room 6.

Package B is in room 5.

Package B is not smaller than Package A.

Checking, after variable KA has just been assigned value R.

c) KA and TH have been assigned values R and G respectively, but no constraint propagation has been done. Cross out all values that would be eliminated **by Arc Consistency**.

d) Consider the assignment below. TH is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the **Minimum-Remaining-Values (MRV) Heuristic**.

KA	LA	MA	MY	TH	VI
G B	G B	G B	G B	R	R G B

e) Consider the same assignment given in (d). List all unassigned variables that might be selected by the **Degree Heuristic.**

f) Consider the complete but inconsistent assignment below. MA has just been selected to be assigned a new value during local search for a complete and consistent assignment. What new value would be chosen below for MA by the Min-Conflicts Heuristic?

KA	LA	MA	MY	TH	VI
B	G	?	G	G	B

5) (The package delivery robot). Assume this robot knows the following facts:

- All packages in room 5 are smaller than those in room 6.
- Package A is either in room 5 or in room 6.
- Package B is in room 5.
- Package B is not smaller than Package A.

a) Select the appropriate predicates and write the given sentences in First Order Logic (FOL).

b) Apply Resolution Rules to prove that Package A is in room 5.

4) You are a map coloring robot assigned to color the South-East Asia map given below. Adjacent regions must be colored a different color (R: Red, B: Blue, G: Green).

KA=Kampuchea
LA=Laos
MA=Malaysia
MY=Myanmar
TH=Thailand
VI=Vietnam

a) Draw the constraint graph of the given map.

b) Cross out all values that would be eliminated by **Forward Checking**, after variable KA has just been assigned value R.

c) KA and TH have been assigned values R and G respectively, but no constraint propagation has been done. Cross out all values that would be eliminated **by Arc Consistency**.

d) Consider the assignment below. TH is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the **Minimum-Remaining-Values (MRV) Heuristic**.

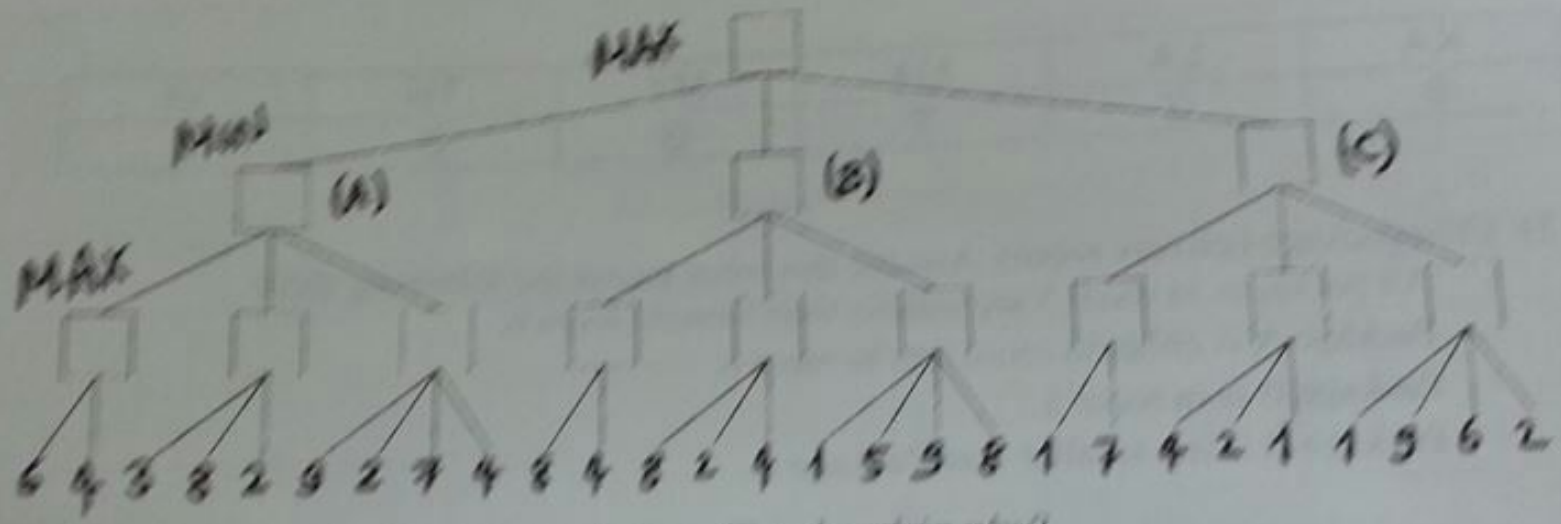
KA	LA	MA	MY	TH	VI
G B	G B	G B	G B	R	R G B

Consider the same assignment given in (d). List all unassigned variables that might be selected by the **Degree euristic.**

Consider the complete but inconsistent assignment below. MA has just been selected to be assigned a new

6	0	0

2) The game tree below illustrates a position reached in the game. Process the tree left-to-right, as is Max's turn to move.



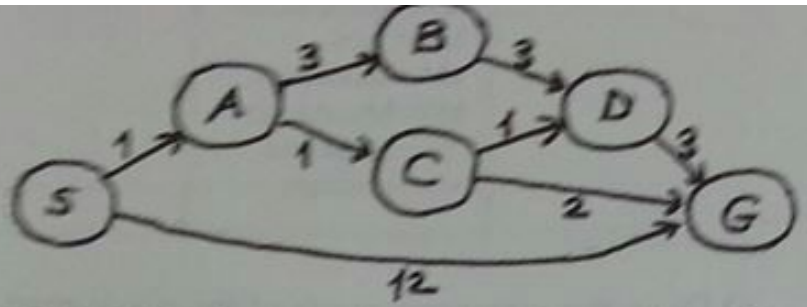
a) What is the best move for Max? (write A, B, or C) and explain why?
b) Process the tree left-to-right. Cross out each leaf node that will be pruned by Alpha-Beta Pruning.

3) You are a robot in a logic-based question answering system, and must decide whether or not an input goal sentence is entailed by your Knowledge Base (KB). Your current KB in CNF(Conjuctive Normal Form) is:

S1: P V Q
S2: (¬P V Q)
S3: (P V ¬Q)
S4: (¬P V ¬Q V ¬S)
S5: (¬P V R V S)

Your input goal sentence is: (P ^ Q ^ R).

a) Write the negated goal sentence in CNF as S6.
b) Use resolution to prove that the goal sentence is entailed by KB, or else explain why no such proof is possible.



Answer the following questions about the search problem shown above. Break any ties alphabetically.

a) What path would A* search, using a consistent heuristic, return for this search problem?

b) Consider the heuristics for this problem shown in the table below. Answer the questions below an explain why?

State	h_1	h_2
S	5	4
A	3	2
B	6	6
C	2	1
D	3	3
G	0	0

i) Is h_1 admissible?
ii) Is h_1 consistent?
iii) Is h_2 admissible?
iv) Is h_2 consistent?

2) The game tree below illustrates a position reached in the game. Process the tree left-to-right. It is **Max**'s turn to move.