Institute of Science and Technology

2078

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Bachelor Level / Second Year/ Forth Semester/ Science

Computer Science and Information Technology (CSC 261)

(Artificial Intelligence)

Full Marks: 60

Pass Marks: 24

Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.

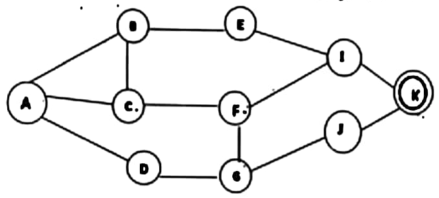
All figures in the margin indicate full marks.

Section A

Long Answer Questions

Attempt any Two questions (2x 10=20)

1. How informed search are different than uniformed? Given following state space, illustrate how depth limited search and iterative deepening search works? Use your own assumption for depth limit.



Hence, A is start an K is goal (3+7)

2. Consider following facts.
Every traffic chases some driver. Every driver who horns is smart. No traffic catches any smart driver. Any traffic who chases some driver but does not catch him is frustated.

Now configure FoPL knowledge base for above statements. Use resolution algorithm to draw a conclusion that " If all drivers horn, then all traffics are frustated." (10)

3. Describe mathematical model of neural network. What does it means to train a neurl network? Write algorithm for perceptron learning. (3+2+5)

Section-B

Short Answer Questions

Attempt any Eight questions. (8x5=40)

4. What is Turing Test? How it can be used to measure intelligence of machine? (3+2)

5. How agent can be configured using PEAS framework? Illustrate with example (5)

6. Construct semantic network for following facts

Ram is a person. Persons are humans. All humn have nose. Humans are instances of mammals. Ram has weight of 60 kg. Weight of Ram is less than weight of Sita. (5)

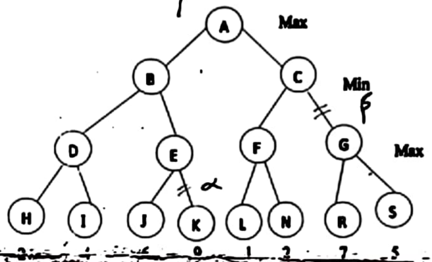
7. What iscrossover operation in genetic algorithm? Given following chromosomes show the result of one-point and two point crossover.
C1 = 01100010
C2 = 10101100
Choose appropriate crossover points as per your own assumption. (2+3)

8. What is expert system? How it works? Mention role of inference engine in expert system. (2+2+1)

9. How semantic and pragmatic analysis is done in natural language processing. (5)

10. How philosophy, sociology and economics influence the study of artificial intelligence? (5)

11. Given following search space, determine if these exists any alpha and beta cutoffs. (5)



12. What is prosterior probability? Consider a scenario that a patient have liver disease is 15% probability. A test says that 5% of patients are alcoholic. Among those patients diagnosed with liver disease, 7% are alcoholic. Now compute the chances of having liver disease, if the patient is alcoholic. (1+4)

P(L/A)

0.21

Artificial Intelligence - 2078

- Ankit Pangeni

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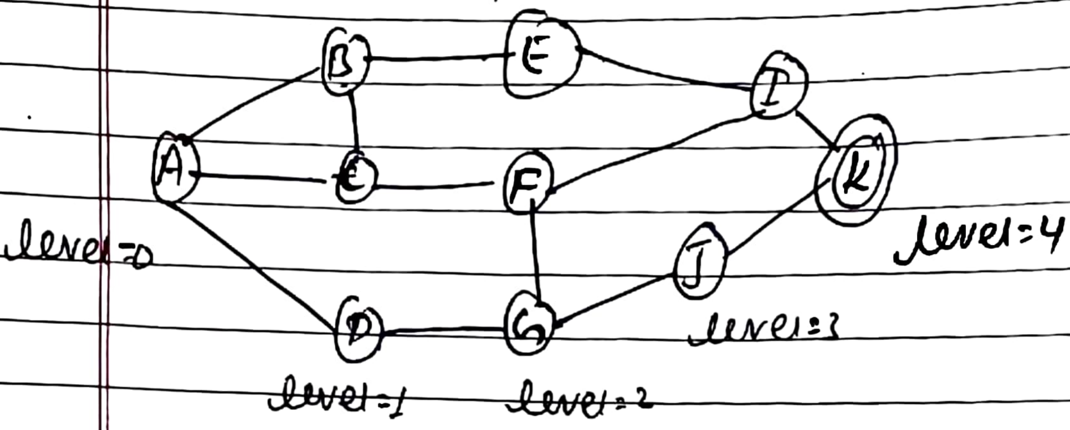
Q.1. How informed search are different than uniformed? Given following state space, illustrate how depth limited and iterative deepning search works? Use your own assumption for depth limit.

	Informed search	Uninformed search.
i)	It uses domain knowledge for the searching process	i) It doesn't use any knowledge for searching Process
ii)	It finds solution more quicky	ii) It finds solution slow as compared to informed search.
iii)	It may or may not be complete.	iii) It is always complete.
iv)	cost is low	iv) Cost is high.
v)	It consumes less time.	v) It consumes moderate time.
vi)	It provides the direction regarding the solution.	vi) No suggestions is given regarding the solution in it.
vii)	It is less lengthy while implementation.	vii) It is more lengthy while implementation
viii)	Ex: Greedy search, A* search, Graph search	viii) Ex: Depth first search, Breadth first search

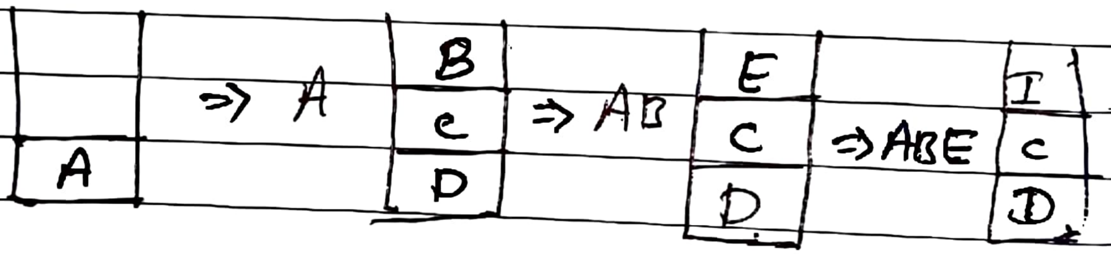
Given state space.

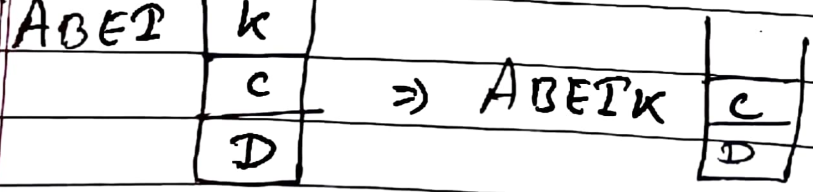


Depth limited search

Let us assume that depth limit = 4 and source = A
destination = K

Since, depth limited search is modified version of depth first search, so let's use a stack



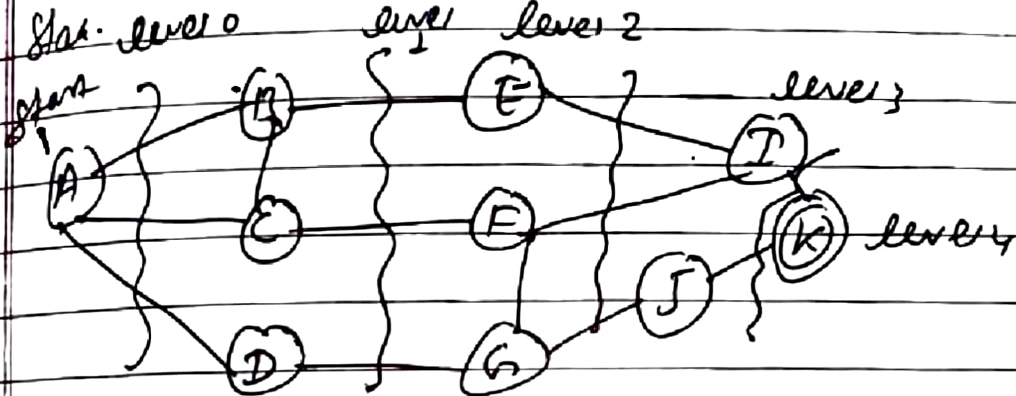


Hence, by using depth limited search, the path from source to destination is

A → B → E → I → K

Iterative deepning search

Iterative deepning search is the combination of Both Breadth first search and depth first search. Here, depth-limited search is run repeadety, increasing the depth limit with each iteration until it reaches depth 'd', the depth of the shallowest goal



	Stack
1st iteration, depth (d) = 0	[A]
2nd iteration depth (d) = 1	[A→B→C→D]
3rd iteration depth (d) = 2	[A→B→E→C→F→D→G]
4th iteration depth (d) = 3	[A→B→E→I→C→F→D→G]
5th iteration, depth (d) = 4	[A→B→E→I→K]

Hence, by using iterative deepning search, the path from source to destination is

A-B-E-I-K

classmate

Q.2. Every traffic chases some driver. Every driver who horns is smart. No traffic catches any smart driver. Any traffic who chases some driver and does not catch him is frustrated.

Now configure FOPL knowledge base for the above statement. Use resolution algorithm to draw the conclusion that "If all drivers horn, then all traffics are frustrated".

=) Let's convert the given facts into FOPL

(1) Every traffic chases some driver

$\forall x \exists y (traffic(x) \land driver(y) \rightarrow chases(x,y))$

(2) Every driver who horns is smart

$\forall y (driver(y) \land horns(y) \rightarrow smart(y))$

(3) No traffic catches any smart driver.

$\forall x \forall y (traffic(x) \land driver(y) \land smart(y) \rightarrow \neg catch(x,y))$

(4) Any traffic who chases some driver and doesn't catch him is frustrated

$\forall x \exists y (traffic(x) \land driver(y) \land chases(x,y) \land \neg catch(x,y) \rightarrow frustrated(x))$

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Let's Convert this to CNF

Step-1: Remove implies conditions

$\forall x \exists y (\neg(traffic(x) \wedge driver(y)) \vee chases(x,y))$

$\forall y (\neg(driver(y) \wedge horns(y)) \vee smart(y))$

$\forall x \forall y (\neg(traffic(x) \wedge driver(y) \wedge smart(y)) \vee \neg catch(x,y))$

$\forall x \exists y (\neg(traffic(x) \wedge driver(y) \wedge chases(x,y) \wedge \neg catch(x,y)) \vee frustrated(x))$

Step-2: Move negation inwards

1) $\forall x \exists y (\neg traffic(x) \vee \neg driver(y) \vee chases(x,y))$

2) $\forall y (\neg driver(y) \vee \neg horns(y) \vee smart(y))$

3) $\forall x \forall y (\neg traffic(x) \vee \neg driver(y) \vee \neg smart(y) \vee \neg catch(x,y))$

4) $\forall x \exists y (\neg traffic(x) \vee \neg driver(y) \vee \neg chases(x,y) \vee catch(x,y) \vee frustrated(x))$

Step-3: Skolemization (removal of existential quantif

1) $\forall x (\neg traffic(x) \vee \neg driver(f(x)) \vee chases(x, f(x)))$

2) $\forall y (\neg driver(y) \vee \neg horns(y) \vee smart(y))$

3) $\forall x \forall y (\neg taffic(x) \vee \neg driver(y) \vee \neg smart(y) \vee \neg catch(x,y))$

4) $\forall x (\neg traffic(x) \vee \neg driver(f(x)) \vee \neg chases(x, f(x)) \vee catch(x, f(x)) \vee frustrated(x))$

Step-4: Remove universal quantifier

① $\neg traffic(x) \vee \neg driver(f(x)) \vee chase(x, f(x))$
② $\neg driver(y) \vee \neg horns(y) \vee smart(y)$
③ $\neg traffic(x) \vee \neg driver(y) \vee \neg smart(y) \vee \neg catch(x, y)$
④ $\neg traffic(x) \vee \neg driver(f(x)) \vee \neg chase(x, f(x)) \vee$
$catch(x, f(x)) \vee frustrated(x)$

Now, conclusion / goal is

$\forall y \forall x (driver(y) \wedge traffic(x) \wedge horns(y) \rightarrow$
$frustrated(x))$

Convert this to CNF to

$\forall y \forall x (\neg(driver(y) \wedge traffic(x) \wedge horns(y)) \vee$
$frustrated(x))$

$\forall y \forall x (\neg driver(y) \vee \neg traffic(x) \vee \neg horns(y) \vee$
$frustrated(x))$

$\neg drivers(y) \vee \neg traffic(x) \vee \neg horns(y) \vee frustrated(x)$

Now, negate the goal

$drivers(y) \wedge traffic(x) \wedge horns(y) \wedge \neg frustrated(x)$

This can be split a

⑤ $drivers(y)$
⑥ $traffic(x)$
⑦ $horns(y)$
⑧ $\neg frustrated(x)$

Resolution graph

driver(y) | ¬traffic(x) ∨ ¬driver(y) ∨ ¬smart(y) ∨ ¬catch(x,y)

¬traffic(x) ∨ ¬smart(y) ∨ ¬catch(x,y) | traffic(x)

¬smart(y) ∨ ¬catch(x,y) | ¬driver(y) ∨ ¬horns(y) ∨ smart(y)

¬catch(x,y) ∨ ¬horns(y) ∨ ¬driver(y), | driver(y)

¬catch(x,y) ∨ ¬horns(y) | horns(y)

¬catch(x,y) | ¬traffic(x) ∨ ¬driver(f(x)) ∨ ¬chases(x,f(x)) ∨ catch(x,f(x)) ∨ frustrated(x).

{f(x),y}

¬traffic(x) ∨ ¬driver(f(x)) ∨ ¬chases(x,f(x)) | traffic(x)

¬driver(f(x)) ∨ ¬chases(x,f(x)) | driver(y)

{y, f(x)}

¬chases(x,y) | ¬traffic(x) ∨ ¬driver(f(x)) ∨ chases(x,f(x))

{f(x),y}

¬traffic(x) ∨ ¬driver(y) | traffic(x)

¬driver(y) | driver(y)

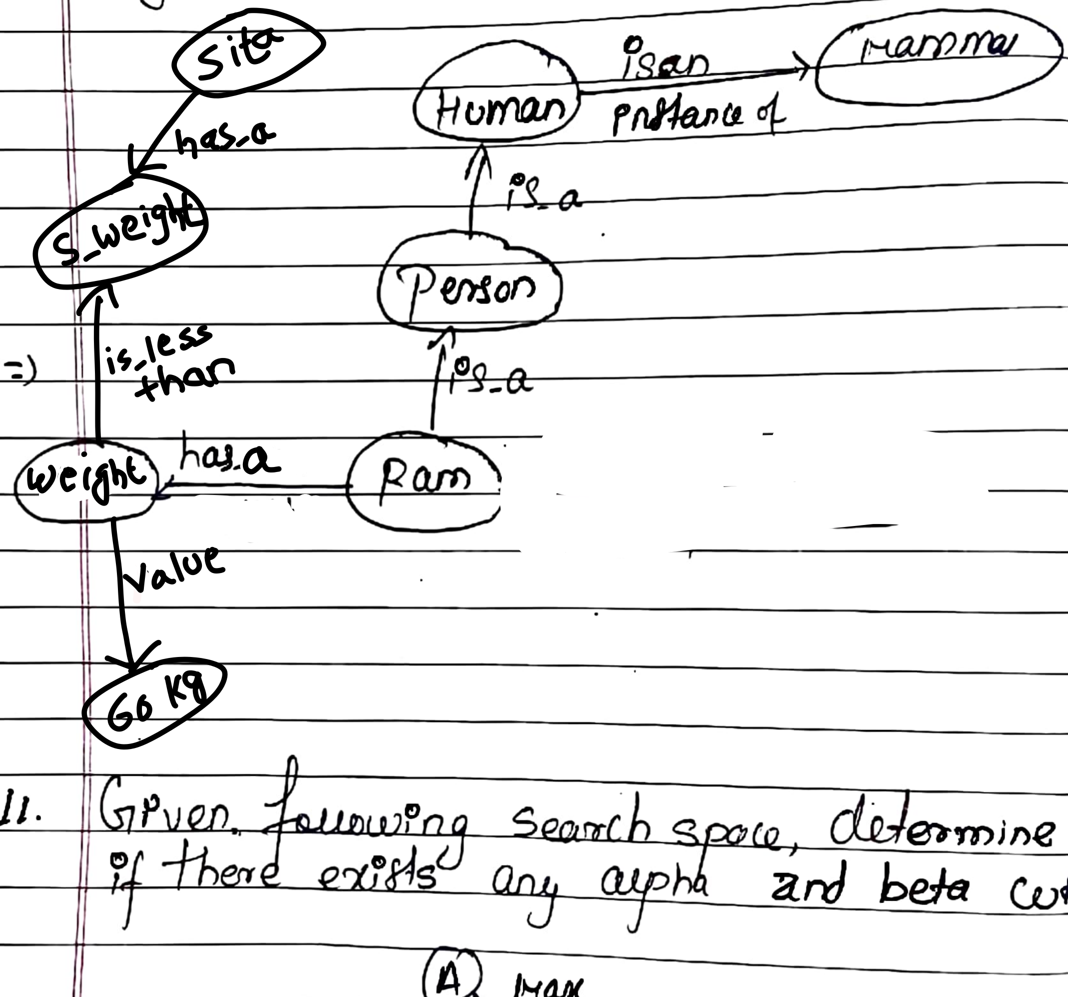
Empty.

... drawn from given facts

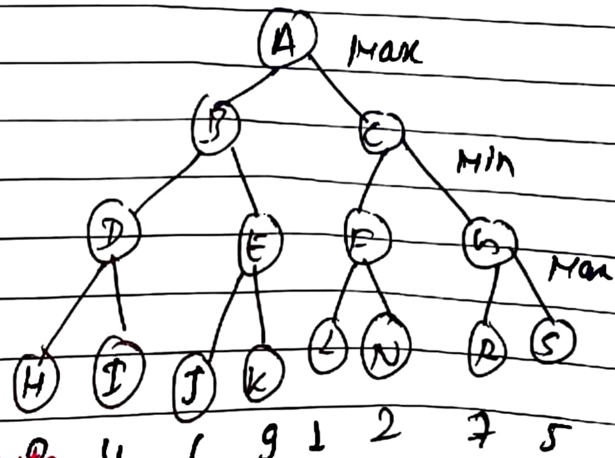
Section-B

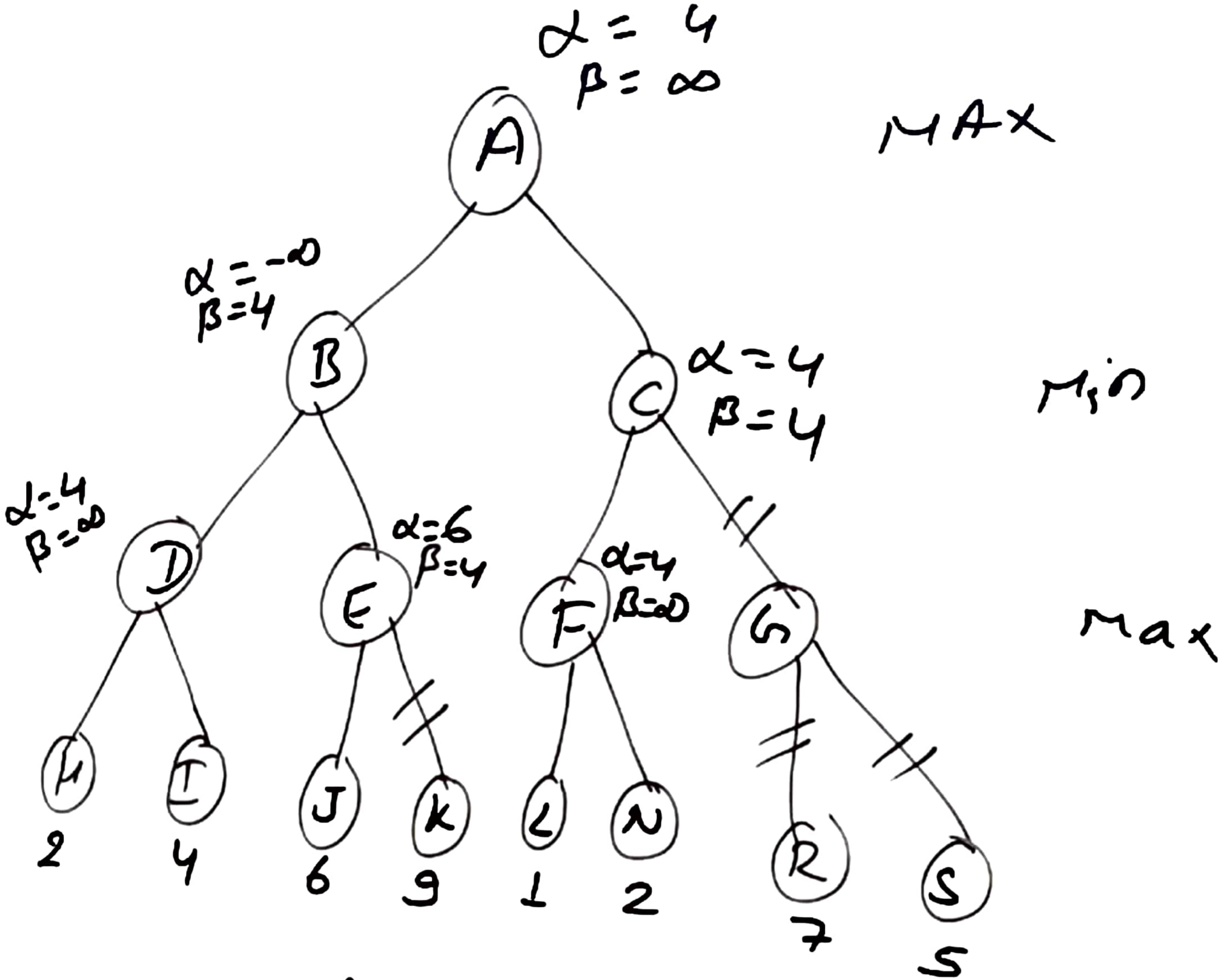
Q.6. Construct semantic network for following facts

Ram is a person. Persons are humans. All humans have nose. Humans are instances of mammals. Ram has weight of 60 kg. Weight of Ram is less than weight of sita

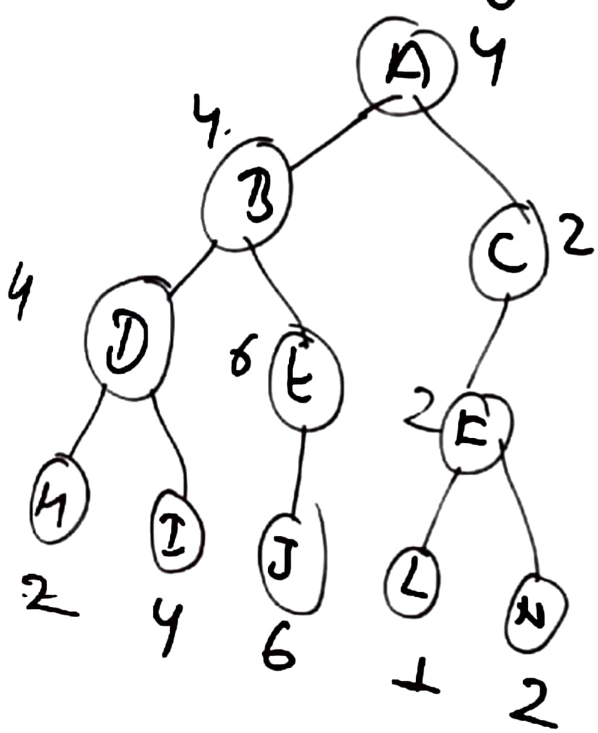


Q.11. Given following search space, determine if there exists any alpha and beta cutoffs





Hence, final figure is



With 3 alpha cutoffs
1 Beta cutoff.

Q.7. What is crossover operation in genetic algorithm? Given following Chromosomes. Show the result of one-point & two point crossover.

$C_1 = 01100010$

$C_2 = 10101100$

Choose appropriate crossover points as per your own assumption

→ Crossover operation in genetic algorithm is used to generate offsprings from the given two Chromosomes. Here, two strings are picked from the mating pool at random to crossover in order to produce superior offspring.

$C_1 = 01100010$

$C_2 = 10101100$

<u>One-point crossover</u>

C_1:	0	1	1	0	0	0	1	0
C_2:	0	0	1	0	1	1	0	0

Let this be the crossover point.

Then, the result of one-point crossover is

d_1: 01101100

d_2: 00100010

where d_1 & d_2 are offsprings of C_1 & C_2.

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Two-point crossover

c_1:	0	1	1	0	0	0	1	0
c_2:	0	0	1	0	1	1	0	0

1st crossover point   2nd crossover point

d_1: 01 101 010

d_2: 00 100 100

extra. **Multi-point crossover**

c_1:	0	1	1	0	0	0	1	0
c_2:	0	0	1	0	1	1	0	0

1st point   2nd poin   3rd poin

d_1: 0 0 1 0 0 1 0 0

d_2 0 1 1 0 1 0 0 0

What is posterior probability? Consider a scenario that a patient have liver disease is 15% probability. A test says that 5% of patients are alcoholic. Among those patient diagnosed with liver disease, 7% are alcoholic. Now, compute the chances of having liver disease, if the patient is alcoholic.

Posterior probability is the probability of one event occuring with some relationship to one or more other events.

Ex: $P(A/B) = \frac{P(A \cap B)}{P(B)}$

Where, $P(A/B)$ is the probability of A occuring given the probability of B.

Given,

Probability of patient having liver disease

$$P(L) = 15\% = 0.15$$

Probability of patient being alcoholic

$$P(A) = 5\% = 0.05$$

Probability of people being alcoholic given that they are having liver disease.

$$P\left(\frac{A}{L}\right) = 7\% = 0.07$$

Now, probability of having liver disease if the patient is alcoholic: $P\left(\frac{L}{A}\right) = ?$

we know,

$$P(L/A) = \frac{P(L) \cdot P(A/L)}{P(A)}$$

$$= \frac{0.15 \times 0.07}{0.05}$$

$$= 0.21$$

$$= 21\%$$

Hence, the probability of having liver disease of the patient is alcoholic is 21%.