KATHMANDU UNIVERSITY
End Semester Examination [C]
April 2023

Marks Scored:

Level : B.E./B.Sc.
Year : IV

Course : COMP 472
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 09 APR 2023

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose the most appropriate answer and **mark [X]** in the box.

1. The task environment for Taxi Driver agent is _____.
   [ ] Fully observable, stochastic, sequential, dynamic
   [ ] Partially observable, stochastic, discrete, dynamic
   [ ] Partially observable, stochastic, sequential, static
   [ ] Partially observable, stochastic ,sequential, dynamic

2. Genetic algorithm uses the concept of _____.
   [ ] A*search
   [ ] neural search
   [ ] Uniform cost search
   [ ] Hill climbing search

3. Which of the following is **NOT** a syntactically legal sentence of Propositional Logic?
   [ ] $p \wedge \neg p$
   [ ] $(p \Rightarrow (q \Rightarrow r)) \Leftrightarrow (s \Leftarrow t)$
   [ ] $p \vee \neg q \wedge \neg p \vee \neg q \Rightarrow p \vee q$
   [ ] $\neg (q \vee r) \neg q \Rightarrow \neg\neg p$

4. Which one of the following is responsible for improving the efficiency of the performance element?
   [ ] Performance element itself
   [ ] Critic
   [ ] Learning element
   [ ] Problem Generator

5. Everyone do not like Iva can be translated as_____ in FOPL.
   [ ] $\exists y \neg likes(Iva)$
   [ ] $\forall x -\exists y$ Likes(x,Iva)
   [ ] $-\forall x \exists y$ Likes(Iva,y)
   [ ] $\neg\exists x$ Likes(x,Iva)

6. Which of the following is a disadvantage of a neural network?
   [ ] Function with only complete or well-structured information
   [ ] Learn and adjust to new circumstances on their own
   [ ] Lend themselves to massive parallel processing
   [ ] Cope with huge volumes of information

7. Which of the following is a proposed means of testing the intelligence of a machine?
   [ ] Semantic analysis
   [ ] Production system
   [ ] Syntactic analysis
   [ ] Turing test

8. A _____ embodies the criterion for success of an agent's behavior.
   [ ] Performance measure
   [ ] Efficiency
   [ ] Rationality
   [ ] Autonomy

9. The best inference rule called Modus Ponens can be expressed as _____.
   [ ] $\alpha \leftrightarrow \beta \models (\alpha \rightarrow \beta) \wedge (\beta \rightarrow \alpha)$
   [ ] $\neg(\alpha \wedge \beta) \models (\neg\alpha \vee \neg\beta)$
   [ ] $\alpha \rightarrow \beta, \alpha \models \beta$
   [ ] $\alpha \rightarrow \beta, \neg\beta \models \neg\alpha$

10. The learning element uses feedback from _____ on how the agent is doing.
[ ] Critic [ ] Performance element
[ ] Learning element [ ] Framework

11. Which one of the following components does not describe the problem best?
[ ] Initial state [ ] Goal state [ ] Path cost [ ] Abstract state

12. The space complexity of Iterative Deepening Search is represented as ('b' indicates the branching factor, 'd' indicates the depth of the goal state) _____.
[ ] O(bd) [ ] $O(b^d)$ [ ] $O(^{bd/2})$ [ ] $O(b^{d+1})$

13. A doctor knows that meningitis causes a stiff neck in 50% of such cases. The prior probability of having meningitis is 1/50,000 and the prior probability of any patient having a stiff neck is 1/20. What is the probability that a patient has meningitis if they have a stiff neck?
[ ] 0.002 [ ] 0.000002 [ ] 0.0002 [ ] 0.00002

14. Which of the following operation happens very rarely in genetic algorithm as compares to others?
[ ] Cross Over [ ] Mutation [ ] Selection [ ] Ignorance

15. Back tracking search is a form of _____ commonly used for solving problems.
[ ] Depth First Search [ ] Breadth First Search
[ ] Uniform cost search [ ] Hill Climbing Search

16. The propositional sentence -PVQ$\wedge$R$\Rightarrow$S is equivalent to _____.
[ ] ((-P)V(Q$\wedge$R)) $\Rightarrow$S [ ] ((-PVQ)$\wedge$R $\Rightarrow$S)
[ ] (-(PVQ)$\wedge$R$\Rightarrow$S) [ ] None of these

17. If h(n) is the heuristics and h*(n) is the true cost then time and space complexity of A * algorithm can be exponential except if
[ ] $|h^*(n)-h(n)| \leq O(\log h^*(n))$ [ ] $|h(n)-h^*(n)| \geq O(\log h(n))$
[ ] $|h(n)-h^*(n)| \leq O(\log h^*(n))$ [ ] $|h(n)-h^*(n)| \geq O(\log h(n))$

18. The propositional sentence ($\alpha \wedge (\beta V \gamma)$) is equivalent to _____.
[ ] $((\alpha \wedge \beta) V (\alpha V \gamma))$ [ ] $((\alpha V \beta) \wedge (\alpha V \gamma))$
[ ] $(\alpha V (\beta \wedge \gamma))$ [ ] None of these

19. If we find a sentence $\alpha \Rightarrow \beta$ and α in a knowledge base then from that KB we can infer_____ knowledge as Modus Ponen.
[ ] β [ ] α [ ] $-\beta$ [ ] $-\alpha$

20. In which of the following joint probability tables are P(A) and P(B) absolutely independent, given that Probability P(a) = 0.2 and Probability P(b) = 0.6
[ ]

	a	$\neg a$
b	0.16	0.42
$\neg b$	0.04	0.28

[ ]

	a	$\neg a$
b	0.10	0.50
$\neg b$	0.10	0.30

[ ]

	a	$\neg a$
b	0.12	0.48
$\neg b$	0.08	0.32

[ ]

	a	$\neg a$
b	0.20	0.40
$\neg b$	0.00	0.40

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SECTION "B"
[2Q. × 8 = 16 marks]

Attempt *ALL* questions.

1. Discuss Well Defined Problem. For the **missionaries and cannibal** problem generate the state space and solve the problem.

2. Differentiate between Goal-based agents and Utility based agents. Explain the PEAS description for online shopping agents.

SECTION "C"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

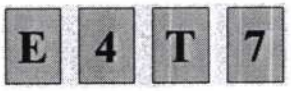
3. Define **Intelligence**. Explain the three different things which are involved in understanding intelligence.

4. Explain in detail how **Uncertainty** is handled in Artificial Intelligence.

5. Explain the situations when **A*** algorithm always gives the optimal solutions.

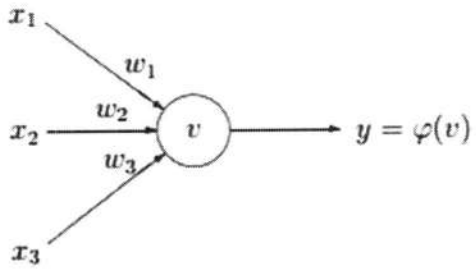
6. Explain the basic theory of **Genetic Algorithm** in solving the engineering problems.

7. Given a pack of cards each of which has a letter written on one side and a number written on the other side as shown in the figure below and it is claimed that the following rule(in italic and bold font) is true:
If a card has a vowel on one side, then it has an even number on the other side.
Explain which card or cards to turn over in order to decide whether the rule is true or false.



8. Translate the following sentence into **first order predicate logic** :
   a. "Everyone's DNA is unique and is derived from their parents' DNA".
   b. "No dog bites a child of its owner".
   c. "Every gardener likes the sun".
   d. "All purple mushrooms are poisonous".

9. Considering a **single neuron artificial neural network** as shown in the figure below,



With w1, w2, w3 being the weight of the inputs x1,x2,x3 and output y = ϕ(v) with activation function as step-function, Calculate the output value y of the unit for each of the following input patterns with the information given as:

w_1	=	2
w_2	=	−4
w_3	=	1

Pattern	P_1	P_2	P_3	P_4
x_1	1	0	1	1
x_2	0	1	0	1
x_3	0	1	1	1

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{otherwise} \end{cases}$$