

Final Exam

Started: Dec 9 at 5:20pm

Quiz Instructions

CSCE 5210 – Fundamentals of Artificial Intelligence

Final Exam

Time: Monday 12/09/2024 from 4:00 PM to 11:59 PM

Instructions:

- The Final Exam will be an **online exam**, and you can do it remotely or in the class room.
- The exam will be available for students on **Monday 12/09/2024 from 4:00 pm to 11:59 pm.**
- The actual time of the exam is only **90 minutes**, and you can start any time when the exam is available.
- The exam contains **41 MCQs (1 point each)**, **3 critical-thinking questions (3 points each)**, and **2 problem-solving questions (5 points each)**.
- For **the problem-solving questions**, you can use the provided space to answer your questions or turn in them by uploading any **pdf/doc file** for each question **separately**, and **showing the name and UNT ID** in each file.

(Remember, the submission of files is not accepted by emails or in comment section of the exam, and any such submission will be ignored and not graded toward this exam)



First part: MCQs

In this part you have 41 questions, and you need to answer all questions by selecting the best answers.



Question 1 1 pts

Which is a refutation complete inference procedure for propositional logic?



Clauses



Variables



Propositional resolution



Proposition



Question 2 1 pts

In artificial Intelligence, knowledge can be represented as_____.

I. Predicate Logic,

II. Propositional Logic,

III. Compound Logic,

IV. Machine Logic



Both I and II



Only II



Both II and III



Only IV



Question 3 1 pts

Which is created by using single propositional symbol?



Complex sentences



Atomic sentences



Composition sentences



None of the mentioned



Question 4 1 pts

What can be viewed as a single lateral of disjunction?



Multiple clause



Combine clause



Unit clause



None of the mentioned



Question 5 1 pts

What is not represented by using propositional logic?



Objects



Relations



Both Objects & Relations



None of the mentioned



Question 6 1 pts

In an Unsupervised learning _____



Specific output values are not given

☐

Specific output values are given

☐

No specific Inputs are given

☐

Both inputs and outputs are given

☐

Question 7 1 pts

What is Decision Tree?

☐

Flow-Chart & Structure in which internal node represents test on an attribute, each branch represents outcome of test and each leaf node represents class label

☐

Flow-Chart

☒

Structure in which internal node represents test on an attribute, each branch represents outcome of test and each leaf node represents class label

☐

None of the mentioned

☐

Question 8 1 pts

Which of the following statements about regularization is not correct?

☐

None of the mentioned

☐

Using too large a value of lambda can cause your hypothesis to underfit the data.

☐

Using too large a value of lambda can cause your hypothesis to overfit the data

☒

Using a very large value of lambda cannot hurt the performance of your hypothesis.

☐

Question 9 1 pts

2. ML is a field of AI consisting of learning algorithms that?

☒

All of the mentioned

☐

Improve their performance

☐

At executing some task

☐

Over time with experience



Question 10 1 pts

What is used in determining the nature of the learning problem?



Feedback



Environment



Problem



All of the mentioned



Question 11 1 pts

If according to the hypothesis, the result should be positive, but in fact it is negative, then it is known as_____.



False Positive Hypothesis



False Negative Hypothesis



Specialized Hypothesis



Consistent Hypothesis



Question 12 1 pts

What takes input as an object described by a set of attributes?



Decision tree



Tree



Graph



Decision graph



Question 13 1 pts

Which of the following is an application of NN (Neural Network)?



All of the mentioned



Sales forecasting



Data validation



Risk management



Question 14 1 pts

Which modifies the performance element so that it makes better decision?



Learning element



Performance element



Changing element



None of the mentioned



Question 15 1 pts

Which of the following would have a constant input in each epoch of training a Deep Learning model?



Weight between input and hidden layer



Weight between hidden and output layer



Biases of all hidden layer neurons



Activation function of output layer



Question 16 1 pts

The network that involves backward links from output to the input and hidden layers is called



Recurrent neural network



Self organizing maps



Perceptrons



Multi layered perceptron



Question 17 1 pts

Having multiple perceptrons can actually solve the XOR problem satisfactorily: this is because each perceptron can partition off a linear part of the space itself, and they can then combine their results.



True – perceptrons can do this but are unable to learn to do it – they have to be explicitly hand-coded



True – this works always, and these multiple perceptrons learn to classify even complex problems



False – perceptrons are mathematically incapable of solving linearly inseparable functions, no matter what you do



False – just having a single perceptron is enough



Question 18 1 pts

Which of the following statements is true when you use 1×1 convolutions in a CNN?



All of the mentioned



It can help in dimensionality reduction



It can be used for feature pooling



It suffers less overfitting due to small kernel size



Question 19 1 pts

Why is the XOR problem exceptionally interesting to neural network researchers?



Because it is the simplest linearly inseparable problem that exists.



Because it can be expressed in a way that allows you to use a neural network



Because it is complex binary operation that cannot be solved using neural networks



Because it can be solved by a single layer perceptron



Question 20 1 pts

CNN is mostly used when there is an?



unstructured data



structured data

☐

Both the mentioned

☐

None of the mentioned



Question 21 1 pts

Which of the following is/are Limitations of deep learning?

☒

Both of the mentioned

☐

None of the mentioned

☐

Data labeling

☐

Obtain huge training datasets



Question 22 1 pts

What is the objective of backpropagation algorithm?

☒

to develop learning algorithm for multilayer feedforward neural network, so that network can be trained to capture the mapping implicitly

☐

to develop learning algorithm for multilayer feedforward neural network

☐

to develop learning algorithm for single layer feedforward neural network

☐

none of the mentioned



Question 23 1 pts

What is meant by generalized in statement "backpropagation is a generalized delta rule" ?

☒

because delta rule can be extended to hidden layer units

☐

because delta is applied to only input and output layers, thus making it more simple and generalized

☐

it has no significance

☐

none of the mentioned



Question 24 1 pts

Which algorithm works by first running the standard forward pass to compute?



Modified smoothing



Smoothing



HMM



Depth-first search algorithm



Question 25 1 pts

Where does the additional variables are added in HMM?



Temporal model



Reality model



Probability model



All of the mentioned



Question 26 1 pts

What is the basic element of a language?



Random variable



Literal



Variable



All of the mentioned



Question 27 1 pts

Which of the given statement is true for Conditional Probability?



Conditional Probability has no effect or relevance on independent events.



Conditional Probability gives 100% accurate results.



Conditional Probability can be applied to a single event.



None of the mentioned

**Question 28 1 pts**

A hybrid Bayesian Network consist_____.



Both Discrete and Continuous variables



Discrete variables only



Discontinuous Variable



Continuous Variable only

**Question 29 1 pts**

How the compactness of the bayesian network can be described?



Locally structured



Fully structured



Partial structure



All of the mentioned

**Question 30 1 pts**

How does the state of the process is described in HMM?



Single discrete random variable



Literal



Single random variable



None of the mentioned

**Question 31 1 pts**

How the entries in the full joint probability distribution can be calculated?



Both Using variables & information



Using variables



Using information



None of the mentioned



Question 32 1 pts

Which allows for a simple and matrix implementation of all the basic algorithm?



Restricted structure of HMM



HMM



Temporary model



Reality model



Question 33 1 pts

Which of the following is Asimov's first and most important law of robotics?



robot actions must never result in damage to the robot



robots must never take actions harmful to humans



robots must follow the directions given by humans



robots must make business a greater profit



Question 34 1 pts

Amazon had been working on a secret AI recruiting tool. The machine-learning specialists uncovered a big problem: their new recruiting engine did not like women. The system taught itself that male candidates were preferable. It penalized resumes that included the word women. This led to the failure of the tool. This is an example of



Data Privacy



AI access



AI Bias



Data Exploration



Question 35 1 pts

Which of the following IS NOT one of the advantages associated with a robotics implementation program?



Low costs for hardware and software



Robots work continuously around the clock



Quality of manufactured goods can be improved



Reduced company cost for worker fringe benefits



Question 36 1 pts

Which of the following statements concerning the implementation of robotic systems is correct?



implementation of robots CAN save existing jobs



implementation of robots CAN create new jobs



robotics could prevent a business from closing



all of the mentioned



Question 37 1 pts

A major thrust of AI is in the development of computer functions associated with human intelligence.



True



False



AI is not associated with human intelligence



None of the mentioned



Question 38 1 pts

What are the major AI ethical concerns related to AI adoption?



Unemployment



Inequalities



Black Box problem



All of the mentioned



Question 39 1 pts

What do we name the area that deals with the behaviour of Artificial Moral Agents?



Machine Ethics



Human-Robot Ethics



AI Ethics



Roboethics



Question 40 1 pts

[**Blank**] has come to represent a time when machines become more intelligent than humans and begin to grow at an accelerated rate.



Prosperity



Singularity



The machine age



Progress



Question 41 1 pts

What do you understand by data privacy risk by AI?



Data plays a vital role in AI systems. The existence of an AI system is impossible without data.



Data management like storage, usage, collection and maintaining data is one important concern.



When the user works on the system, the user is sharing data. This data needs permission to access the data. This consent is known as data privacy.



All of the mentioned



Second part: Critical Thinking Questions

In this part you have only 4 questions, and you need to answer all questions to point that satisfy the right answer, and do not spend much time to express your answer.



Question 42 3 pts

How do you know when you have completed a successful derivation using:

(a) the bottom-up proof procedure?

(b) the top-down proof procedure?

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b. Top-Down Proof Procedure

In the top-down proof procedure, I start with the goal or query and work backward by applying inference rules to find supporting evidence or sub-goals. A successful derivation happens when all sub-goals are resolved using known facts or axioms. This approach ensures soundness by staying within the logical framework of the rules. Completeness depends on my ability to explore all possible ways to decompose the goal into manageable sub-goals. The process stops when the goal is proven or when no valid sub-goal expansions are available. To improve efficiency, I focus on directly relevant rules and facts. A derivation is successful when I can trace the original goal back to true facts in the knowledge base. I think of this process as pruning a search tree, starting from the root (the goal). The proof is complete when I fully satisfy the initial query through backward reasoning.

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Question 43 3 pts

(a) What is a cross validation and why it is important in supervised machine learning?

(b) What do we mean by classification is a linear separable? By which method you can insure that for the XOR function?

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between training and validation while maximizing data usage.

b. A classification problem is considered linearly separable when there exists a straight line (in two dimensions) or a hyperplane (in higher dimensions) that can separate the data points of different classes without any overlap. This means that the classes can be distinguished using a linear decision boundary. However, for the XOR function, the problem is not linearly separable because the classes are interleaved in such a way that no single straight line can divide them correctly. To address this, methods like adding a non-linear transformation or using a kernel trick in algorithms like Support Vector Machines (SVM) can ensure separability. For example, mapping the XOR function into a higher-dimensional space (e.g., using polynomial or radial basis function kernels) allows the data points to become linearly separable in that transformed space, making classification possible.

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Question 44 3 pts

Some critics object that AI is impossible, while others object that it is *too* possible and that ultraintelligent machines pose a threat. Which of these objections do you think is more likely? Would it be a contradiction for someone to hold both positions?

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AI does pose a potential threat in the near future, though not immediately, which makes it reasonable to hold both positions without contradiction. On one hand, achieving true general AI that replicates human intelligence may seem impossible due to the complexity of consciousness and ethical reasoning. On the other hand, the rapid advancement of narrow AI in specific domains raises valid concerns about its potential misuse or unintended consequences, such as bias, loss of autonomy, or malicious applications. One can believe that while true AI might never be fully realized, the increasing power of specialized AI systems could still pose significant risks. This dual perspective acknowledges the current limitations of AI while recognizing its potential to become a disruptive force if not responsibly managed.

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Third part: Problem-Solving Questions

In this part you have only 2 questions, and you need to answer all questions clearly by showing your derivation of the solution and any figure explaining your answer.



Question 45 5 pts

Given the following knowledge base which is a part of a program to determine whether or not to accept students who have applied for admission to a college.

accepted (Student) <-- returning (Student) \wedge goodStanding(Student) \wedge clearBalance (Student).

accepted (Student) <-- appComplete (Student) \wedge qualified (Student).

qualified (Student) <-- legacyStudent (Student).

qualified (Student) <-- highSAT (Student) \wedge goodHS (Student).

legacyStudent (Student) <-- child (Student, Parent) \wedge graduate (Parent).

goodHS (chris).

graduate (sam).

child (chris, sam).

appComplete (chris).

returning (laura).

goodStandinga (laura).

(a) Show the top-down (SLD) derivation of the query ***accepted(chris)*** applied to the KB.

(b) Show one of the failing top-down (SLD) derivations of the query ***accepted(laura)*** applied to the KB.

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Question 46 5 pts

Suppose you have a Bayesian network that has the probabilities:

$$P(A), P(B|A), P(C|B), P(D|A, C), P(E|B), P(F|E).$$

(a) Draw the belief network that has these conditional probabilities.

(b) In the belief network, each variable is Boolean. That is: $A = \text{true}$ is written as a and $A = \text{false}$ is written as $\neg a$, and similarly for the other variables. Suppose you want to compute $P(d)$. What variables can be pruned?

(c) In this belief network, you have the following conditional probabilities:

$$P(a) = 0.8 \quad P(d|a \wedge c) = 0.5 \quad P(e|b) = 0.9 \quad P(b|a) = 0.9$$

$$P(d|a \wedge \neg c) = 0.6 \quad P(e|\neg b) = 0.4 \quad P(b|\neg a) = 0.3 \quad P(d|\neg a \wedge c) = .7$$

$$P(f|e) = 0.3 \quad P(c|b) = 0.9 \quad P(d|\neg a \wedge \neg c) = 0.2 \quad P(f|\neg e) = 0.8$$

$$P(c|\neg b) = 0.3$$

You want to compute $P(d)$ and are going to eliminate A first. What is the resulting factor after eliminating A ? You need to show the variables that this is a factor on and you must show the first *three* elements of the factor numerically, but don't simplify them (e.g., you should write them as $0.1 * 0.2 + 0.3 * 0.4 + 0.5$).

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