

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR
B.TECH CST (7th sem) Mid-Semester EXAMINATION, Sept 2023

Mobile and Pervasive Computing (CS4123)

F. M. = 30

Time – 2 hrs

Answer all questions

1. i) Which of the following is the process performed at receiver end in mobile communication?

- A) Modulation B) Demodulation C) Decoding ☒ D) Both B) & C)

ii) Which of the following stores the data related to the user?

- ☒ A) SIM B) HLR C) VLR D) AUC

iii) Which type of multiplexing enables to use of the whole bandwidth simultaneously?

- A) FDMA ☒ B) CDMA C) TDMA D) None of these

iv) Select the incorrect statement about TDMA from the following options:

- ☒ A) High transmission rate B) Discontinuous data transmission
C) Single carrier frequency for single user D) All of these

v) How is the capacity of the radio enhanced in cellular network?

- A) By increasing the total base stations and by channel reuse ✓
B) By increasing the spectrum of the radio ☒ C) Both of these D) None of these

vi) Which technique is used to increase cell capacity using directional antenna?

- (A) Cell Splitting
(B) Coverage zone approaches
☒ (C) Cell Sectoring
(D) Cell Sectoring and Cell Splitting both

vii) In CDMA, transmission power of mobile devices needs to be adjusted to mitigate the following problem

- A) Hidden station problem B) Exposed station problem ☒ C) Near-far problem
D) All of these

viii) Primary GSM uses uplink frequency in the range between _____.

- ✓ A) 890- 915 MHz B) 935-960 MHz C) 880-915 MHz D) 925-960 MHz

ix) Which of the following needs to be estimated for allocating RF number of channels to meet GOS.

- ✓ A) Cost B) Capacity C) SNR D) All the above

x) Visitor location register is integrated with which of the following?

- ✓ A) MSC B) HLR C) PSTN D) All these

[10x1=10]

2. a) Write steps of operation for setting a call from mobile to mobile.

b) What roles the channels FVC, RVC, FCC and RCC play in cellular mobile network?

[5+5]

3. a) Describe different channel assignment strategies in 2G cellular network.

b) i) In a cellular system 40 MHz bandwidth is allocated. The system uses two 20 KHz simplex channels to provide full duplex voice and control channels. How many number of channels each network cell may get for a 12-cell reuse system?

ii) Consider the system covers 2310 sq. km and each cell area is 6 sq km. Calculate the system capacity.

[5+5]

Indian Institute of Engineering Science and Technology, Shibpur

B.Tech (CST 7th semester) Mid-Semester Examination, September, 2023

Machine Learning: (CS 4102)

Full Marks: 30

Time: 2 hours

Answer any three questions

1. a. Derive a gradient descent training algorithm that minimizes the sum of the squared error cost function, for the following hypothesis:

$$h_{\theta}(x) = \theta_0 + \theta_1 x_1 + \theta_1 x_1^2 + \theta_2 x_2 + \theta_2 x_2^2 + \dots + \theta_n x_n + \theta_n x_n^2$$

where (x_1, x_2, \dots, x_n) represents an instance having n features and $\Theta_i, 0 \leq i \leq n$ represents the parameters to be learned. Assume that the number of training instances is m . Give your answer in the form $\theta_j =: \theta_j + \dots$ for $1 \leq j \leq n$.

- b. What is kernel in SVM and why do we use kernels? What is K-fold cross-validation? How does it affect bias and variance? [7+3]

2. (a) State the role of margin in SVM.

(b) Explain the difference between Hard Margin and Soft Margin for SVM.

(c) Consider the case of a binary classification starting with training data of 8 tuples, as shown in the following Table. Find parameters W (weight) and b , considering the quadratic programming and KKT constraints to obtain the Lagrange multipliers λ_i for each training tuple. [2+3+5]

x_1	x_2	y	λ
0.38	0.47	+	65.52
0.49	0.61	-	65.52
0.92	0.41	-	0
0.74	0.89	-	0
0.18	0.58	+	0
0.41	0.35	+	0
0.93	0.81	-	0
0.21	0.10	+	0

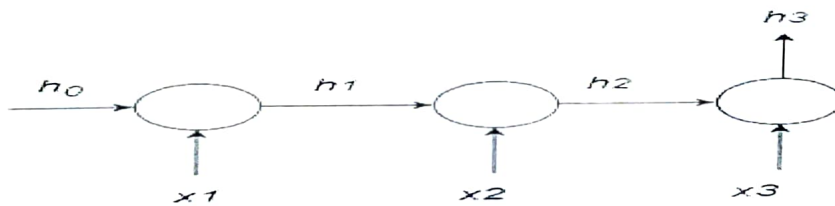
3. (a) State two reasons why linear regression is not ideal for use in classification. Why mean squared error cost function is not used with logistic regression? Write the cost function that is used instead.

(b) Suppose you are given a model for binary (two-class) logistic regression. Explain briefly (e.g., 2-3 sentences each) how multiclass classification can be performed with the binary classifier using the following strategies: (i.) One vs. All, (ii) One vs. One. If c is the number of classes and m is the number of training examples given, mention how many instances of the binary classifier will be required in each of the above two cases. [5+5]

4. a) Calculate the output y of a three input neuron with bias. The input feature vector is $(x_1, x_2, x_3) = (0.8, 0.6, 0.4)$ and weight values are $[w_1, w_2, w_3, b] = [0.2, 0.1, -0.3, 0.35]$. Use binary sigmoid function as activation function.

b) Consider a situation where a biased coin with probability of head(p) is tossed N times and the outcomes (head=1, tail=0) are recorded in random variables, $x_n, n=1, 2, \dots, N$. Derive the log likelihood function for estimating parameter p . [3+7]

5. a) Consider a vanilla RNN cell of the form $h_t = \tanh(V \cdot h_{t-1} + W \cdot x_t + b)$. The figure below shows the input sequence x_1, x_2 , and x_3 . Given the dimensions $x_t \in \mathbb{R}^3$ and $h_t \in \mathbb{R}^5$, what is the number of parameters in the RNN cell?



b) Explain the main difficulties to train RNNs. Specify the ways to handle them. Explain what gating mechanisms are in context of LSTM units.

c) What is the difference between vanilla RNNs and LSTMs? Why don't we use Long Short Term memory networks for smaller datasets or problems? [3+3+4]

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech. - M.Tech. Dual Degree 7th Semester (CST) Examination (Mid Semester) 2021/22
Compiler Design (CS 4101)

Full Marks: 30

Time: 2 Hours

Answer Question-1 and any three from the remaining.

Do all parts of a question together. Do not mix up answers to parts of different questions in the answer script.

1. (a) List out the functions of a Lexical Analyzer. State the reasons for the separation of Analysis programs into Lexical, Syntax, and Semantic Analyses.
- (b) Explain the various errors encountered in different phases of compiler.

[3 + 3 = 6]

2. (a) Discuss how finite automata is used to represent tokens and performs lexical analysis with examples.
- (b) Explain panic mode error recovery strategy for predictive parsing method using a suitable example.

[3 + 5 = 8]

3. Consider the following Grammar production rules where E is the start symbol:

$E \rightarrow E + T | T$

$T \rightarrow TF | F$

$F \rightarrow F * | a | b$

- (a) Eliminate left recursion from the above grammar.
- (b) Compute FIRST & FOLLOW set for the non-terminals. Check the grammar is LL(1) or not; Show the parsing for $a + a + a$.

[2 + 6 = 8]

4. (a) What are the use of shift reduces parser? Explain conflicts that may occur during shift-reduce parsing.
- (b) What do you mean by handle pruning in bottom-up parsing? Explain with the help of the grammar $S \rightarrow SS + | SS * | a$ and input string $aaa * a + +$. In each reduction indicate the corresponding handle.

[3 + 5 = 8]

5. Construct the SLR sets of items for the grammar where E is the start symbol:

$E \rightarrow E + T | T : T \rightarrow TF | F : F \rightarrow F * | a | b$

Show the SLR parsing table for this grammar. Is the grammar SLR?

[5 + 3 = 8]

SLR

Module I

FINANCE

Answer any one question. Each question carries 10 marks.

1. a Define Cost. b. What is Costing? c. Briefly explain the Methods of costing. d. Why different Methods of costing are needed? (2+1+5+2)
2. a. Explain cost classifications based on traceability with examples.
b. Calculate Selling & Distribution overheads:

- ✓ Power & Fuel ₹10,000/
- ✓ Advertisement ₹1,80,000/
- ✓ Meeting expenses ₹54,000/
- ✓ Salesmen's Salaries & Commissions ₹1,00,0000/
- ✓ Packing Charges ₹56,000/
- ✓ Debtors ₹1,34,00/
- ✓ Creditors ₹32,000/
- ✓ Carriage outwards ₹67,000/
- ✓ Showroom Rent ₹70,000/
- ✓ Office Rent ₹95,000/
- ✓ Show Room Lighting ₹58,000/
- ✓ Sales ₹5,32,000/
- ✓ Stores Manager' Salary ₹80,000/

(2+8)

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Module II

ECONOMICS

Attempt any one part.

PART-A

1. (a) Define and state the differences between GDP and GNP.
- (b) Suppose you sell your three year old mobile phone to your friend. Will the income earned by you be counted in the current year's GDP calculation? Explain your answer. (2+1)
2. Complete the statements taking the correct option from the options provided below :
- (a) In the circular flow of income model the factor payments/wages are made/given to
- (i) Firms (ii) Households (iii) Foreign Firms (iv) all of the above.

(b) In the circular flow of income model, without leakages and injections, the magnitude of income flowing in the system remains.....

- (i) Constant (ii) increases as time passes (iii) undecided (iv) doubles as time passes

(1+1)

3. Assume a country named "X" produces only two goods viz. Apples and Oranges.

Suppose in the year 2023 price of apples is Rs. 20 and price of oranges is Rs. 12 while their production is 100 kgs and 150 kgs respectively in the country.

Calculate the Nominal GDP of "X" for the year 2023 and also the Real GDP for the year 2023 with base year as 2020. Price of apples and oranges in 2020 were Rs.5 per kg and Rs.8 per kg respectively.

Define GDP deflator.

(1+1)

4. Calculate GDP and GNP. Also Calculate GNP at Factor Cost:

Final Consumption expenditure ₹ 300; Domestic Capital formation (Investment) ₹800;

Exports ₹250; Imports ₹550; Expenditure of the government ₹200; Payments to factors

abroad ₹100; Income from abroad ₹500; Net indirect tax ₹100; Debt interest income ₹20;

Depreciation ₹25.

(3)

PART-B

5. State the functions of money. State which functions of money the following items satisfy. a. Cash money b. Bitcoin c. Real Estate property

(1+3)

6. State the differences between Commercial Bank and a Central Bank of a country.

Explain how commercial banks create money supply.

(2+4)

Module III

MANAGEMENT

Answer any two questions. Each question carries 5 marks.

1. Illustrate diagrammatically and define the different types of managerial styles as prescribed by the managerial grid.

(2.5+2.5)

2. Write a brief note on the Hawthorne studies.

(5)

3. What are the different types of managerial functions?

(5)

4. Differentiate between transactional and transformational leadership styles.

(2.5+2.5)

Indian Institute of Engineering Science and Technology, Shibpur
B Tech/B Arch 7th Semester End-Semester Examination, November, 2023
FINANCE ECONOMICS & MANAGEMENT for ENGINEERS(HSS III)(HU - 4101)

Full Marks:50

Time: 3 Hours

(Use Separate Answer scripts for two halves. Answer Module wise and start writing Answers for each

Module on a separate page)

Each Module carries 16 marks (3x16=48) + 2 marks for neatness

1st Half

Neat & Clean 😊

Finance Module

1. Explain with example Element wise OR Behaviour wise Cost classification. (6)
2. Explain briefly the long Term Sources of Finance. (4)
3. What is NPV? From the following Information give your opinion about which project should be selected assuming the discounting rate being 10% ?

Name of the Project		<u>Project A</u>	<u>Project B</u>
Life		4 Years	5 Years
Investment		₹2Lakhs	.5 Lakhs
Estimated Cash Inflows(₹)			
Year	1	50,000	35,000
	2	56,000	66,000
	3	61,000	64,000
	4	72000	68000
	5	nil	23,000

PV Factor at 10% for 1 to 5 years are 0.909/0.826/0.751/0.683/0.621(2+4)

Management Module

Answer any two questions. Each question carries 8 marks.

4. List the 4 phases of the strategic management process. According to the Porter's 5 forces model what are the possible threats of entry to a new entrant in an industry? (2+6)
5. Illustrate diagrammatically and write a short note on the Ansoff matrix. How can a company achieve cost leadership? (5+3)
6. Give a detailed explanation of the different linear models of communication. (8)

2nd Half

Economics Module

7. Explain simple Keynesian model of Income Determination graphically. Explain the concept of Investment multiplier. Assume the value of marginal propensity to consume rises, what will be its effect on the magnitude of investment multiplier? (3+1+2)
8. State the law of demand. Keeping in mind that price is determined at the point of intersection of supply and demand curves, consider a situation when there is a rise in income of the individual. What will happen to the equilibrium price? Explain using demand and supply curves. (1+4)
9. What is the law of diminishing marginal utility? Derive the demand curve using the concept of diminishing marginal utility. (1+4)

OR

10. Define GDP. Refer to the table below and calculate the value of GNP. Statement: Rich countries have high GDP. Hence high GDP of a country ensures greater welfare of the people. What is the problem with the above statement? (1+2+2)

<u>Particulars</u>	<u>Dollars(\$)</u>
Final Consumption expenditure	450
Investment	700
Exports	1000
Imports	550
Expenditure of the government	300
Payments to factors abroad	200
Income from abroad	500
Net indirect tax	100
Debt interest income	20
Depreciation	25

Indian Institute of Engineering Science and Technology, Shibpur

B.Tech (CST 7th Semester) End Semester Examination, November 2023

Machine Learning (CS4102)

Full Marks: 50

Time: 3 Hours

Answer any five questions

1. a) State two reasons why linear regression is not ideal for use in classification. Why is the mean squared error cost function not used with logistic regression? Write the cost function that is used instead.

(b) Suppose you are given a model for binary(two-class) logistic regression. Explain briefly, how multiclass classification can be performed with the binary classifier using the following strategies: (i.) One vs. all, (ii) One vs. One. If c is the number of classes and m is the number of training examples given, mention how many instances of the binary classifier will be required in each of the above two cases.

c) Consider Table 1 showing predictions by a classifier as well as the original labels. There are two classes: positive (p), and negative (n). Calculate the following metrics with respect to class p: i) Precision, ii) Recall, iii) True Positive Rate, and iv) F1 Score. [3+3+4]

No.	Prediction	Actual Class
1	P	P
2	P	n
3	n	n
4	P	n
5	p	P

Table 1: Classifier prediction and actual classes

- 2) (a) Using the dataset below, build a decision tree that classifies Y as T/F given the binary variables A, B, and C. Draw the tree that the greedy algorithm would learn with zero training error.

A	B	C	Y
F	F	F	F
T	F	T	T
T	T	F	T
T	T	T	F

- (b) What is K-fold cross-validation? How does it affect bias and variance?
- (c) State two reasons, why linear regression is not ideal for classification? Why mean squared error cost function is not used in logistic regression? Write the cost function that is used instead.
- (d) What are the basic differences between feed forward network and a recurrent network. [4+2+2+2]
- 3) (a) Explain the significance of the RELU activation function in Convolution Neural Network.
(b) Explain Max-Unpooling operation for increasing the resolution of feature maps.

(c) Why do we prefer Convolutional Neural networks (CNN) over Artificial Neural networks (ANN) for image data as input? [4+3+3]

4. a) Calculate the output y of a three-input neuron with bias. The input feature vector is $(x_1, x_2, x_3) = (0.8, 0.6, 0.4)$ and weight values are $[w_1, w_2, w_3, b] = [0.2, 0.1, -0.3, 0.35]$. Use binary Sigmoid function as activation function.

b) Consider a situation where a biased coin with the probability of head(p) is tossed N times and the outcomes (head=1, tail=0) are recorded in random variables, $x_n, n=1, 2, \dots, N$. Derive the log-likelihood function for estimating parameter p . Derive SGD algorithm for solving the max-likelihood problem derived above.

c) There are two common ways to estimate classifier performance i) by using n -fold cross-validation (typically n is 5 or 10) or ii) measure performance on a test set that is distinct from the learning and validation (if used) sets. When will you use cross-validation and when performance on a test set. Provide justification for the answer. [3+3+4]

5. a) What is the vanishing/exploding gradient problem and how is it related to Recurrent Neural Network?

b) Explain Long-term short memory (LSTM) and Gated Recurrent Unit (GRU). How they are different from each other?

c) What is the objective of an Auto Encoder? How auto-encoder is used in dimensionality reduction and image de-noising? What purpose do they serve in comparison to regular auto encoders [3+3+4]

6. a) The Convolutional Neural Network(CNN) has the following database of images below. Each image is of size 100×100 with 3 channels. i.e, the input to the CNN has the dimension of $100 \times 100 \times 3$ and the output has 10 classes. All convolution filters have stride 1 and pooling functions has stride 2. What is the total number of parameters in each of the layer?

Output
Softmax-10
FC1:Fully Connected
P2: 2x2 max pooling
C3:Conv 3x3 -20,pad 2
P1: 2x2 max pooling
C2: Conv 5x5 -20,pad 2
C1: Conv 3x3 -20,pad 1
Input $100 \times 100 \times 3$

Database

b) How do auto encoders handle sparse data? Explain function of auto encoder using sparse data. Are there any specialized auto encoder architectures designed for sparse inputs?

c) i)What is the basic idea behind variational auto encoder?

ii)How have variational auto-encoders been integrated and used in transfer learning? Explain the learning smooth latent state representations of variational auto encoder with example. [3+4+3].

Indian Institute of Engineering Science and Technology, Shibpur
Dual Degree (B.Tech. - M.Tech.) 7th Semester (CST) Examination (End Semester)
November, 2023
Compiler Design (CS 4101)

Full Marks: 50

Time: 3 Hours

Answer Question-1 and any four from the remaining.

Do all parts of a question together. Do not mix up answers to parts of different questions in the answer script.

1. (a) Write regular expressions to specify the identifiers and constants of C.
(b) What do you mean by left factoring of grammar? Explain.
(c) What is a handle in bottom up parsing? Explain.

[2 + 2 + 2 = 6]

2. Consider the following Grammar production rules where S is the start symbol:
 $S \rightarrow ACB|CbB|Ba$; $A \rightarrow da|BC$; $B \rightarrow g|e$; $C \rightarrow h|e$

- (a) Eliminate left recursion from the above grammar.
(b) Compute FIRST & FOLLOW set for the non-terminals. Check the grammar is LL(1) or not; Show the parsing for "ghhg".

[3 + 4 + 1 + 3 = 11]

3. (a) Explain the model of shift reduces parser? Explain conflicts that may occur during shift-reduce parsing.
(b) Construct the CLR parsing table for the following grammar where S is the start symbol:
 $S \rightarrow L = R|R$
 $L \rightarrow *R|id$
 $R \rightarrow L$

[5 + 6 = 11]

4. (a) Explain the use of symbol table in compilation process. List out the various attributes for implementing the symbol table.
(b) Generate intermediate code for the following code segment along with the required syntax directed definition:

```
if (a > b)
    x = a+b;
else
    x = a-b;
```

Here datatype for x , a and b are int.

[6 + 5 = 11]

5. (a) Explain the algebraic translations of local machine-independent optimizations.
(b) Discuss the following: i) Dead code elimination and ii) copy propagation.
(c) Explain loop optimization in detail using a suitable example.

[3 + 4 + 4 = 11]

6. (a) Translate the expression $-(a+b)*(c+d)+(a+b+c)$ into: (i) quadruples, (ii) triples and (iii) indirect triples.
(b) List the field in an activation record. Write down the purpose of each of these fields in an activation record.
(c) Explain the sequence of stack allocation process for a function call using suitable example.

[3 + 5 + 3 = 11]

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech(CS) 7th Semester Final Examinations, Nov-Dec 2023
Mobile and Pervasive Computing (CS4123)

F. M. = 50

Time – 3 hrs

Answer Question No. 1 and any two from the rest.

1. Define the following terms and state their usage:
 - a) Softer-handover
 - b) HLR
 - c) User plane
 - d) Control plane
 - e) MIMO

[5x2]
2.
 - a) Define GOS. Write assumptions (if any) in case of blocked calls cleared trunking system.
 - b) Define Erlang. How many users can be supported for 0.5% blocking probability for 20 number of trunked channels in a blocked calls cleared system. Assume each user generates 0.1 Erlang traffic. From Erlang chart it is given that total system load for 0.5% blocking is 11.10.
 - c) Write the algorithmic steps of CSMA/CA in WLAN.
 - d) What is tunneling in Mobile-IP?

[4x5]
3.
 - a) What are the major components of UTRAN? Briefly state the tasks of each of the components.
 - b) In UMTS signaling protocol stack, what roles are played by 'Call management' and 'Mobility management'?

[15+5]
4.
 - a) What is 5G core network? What are the tasks performed by it?
 - b) Write the tasks of the following functions:
 - i. NRF
 - ii. NSSF
 - iii. PCF
 - iv. UDM

[10+10]
5. Write short notes on the following:
 - a) Career aggregation
 - b) Pervasive Computing

[10+10]