

Seat No.: _____

Enrolment No. _____

NATIONAL FORENSIC SCIENCES UNIVERSITY
M.TECH. ARTIFICIAL INTELLIGENCE & DATA SCIENCE
Semester – I – January - 2024

Subject Code: CTMTAIDS SI P5

Date: 10/01/2024

**Subject Name: Introduction to Forensic Science
and Cyber Law**

Time: 2:00 PM to 5:00 PM

Total Marks: 100

Instructions:

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

	Marks
Q.1	Attempt any three.
(a)	08
What do you understand from the term forensic science? Discuss the history and development of forensic science in India.	
(b)	08
Discuss the working and organizational setup of National Crime Records Bureau (NCRB) and Fingerprint Bureaus.	
(c)	08
Discuss Sec No. 66 of Cyber IT act with appropriate case-study.	
(d)	08
Discuss the basic principles of forensic science and their significance.	
Q.2	Attempt any three.
(a)	08
Discuss the organizational set up of central and state forensic science laboratories in India	
(b)	08
Discuss about the data depiction and process of forensic report writing in details.	
(c)	08
Discuss about the terminology of Law, Court, Judge, FIR and Punishment.	
(d)	08
Describe the international perspectives of forensic science.	
Q.3	Attempt any three.
(a)	08
Describe the criminal procedure code (CrPC) and explain the sections 291, 291A, 292 & 293.	
(b)	08
What is the INTERPOL and FBI? Describe the structure and setup of INTERPOL and FBI.	
(c)	08
Write a note on police and detective training schools and its functions.	
(d)	08
Discuss the important tool and techniques useful in the different fields of forensic science.	

Q.4

Attempt any two.

- (a) Explain the duties of forensic scientists in various discipline and discuss the code of conduct for forensic scientists
- (b) Explain the terms cognizable and non-cognizable offences. Bailable and nonbailable offences.
- (c) Describe the various contemporary disciplines of forensic sciences with their significance.

Q.5

Attempt any two.

- (a) Describe about various computer storage devices and list out the volatile vs non-volatile memory difference.
- (b) Enlist the sentences which the court of magistrate may pass and discuss about objective and kind of punishment.
- (c) Explain the Indian penal code sections 299, 300, 375 & 377

--- End of Paper---

National Institute of Forensic Sciences निष्ठा अमृत आर्थिक 	gram Name – M.Tech Artific ject Name- Introduction to F e- 45 minutes ructions - 1) Answer all ques Multiple Choice Que
I.	The first Fo a. Delhi b. Mumbai c. Agr d. Kol
II.	Choose the a. Pro b. Sci c. Gi d. Al
III.	Choose ap Forensic s a. Id b. E c. R d. A
IV.	When Tw materials a. I b. I c. I d. I
V.	Write th



National Forensics Sciences University, Goa Campus
M.Sc. CS - Semester -II
Mid- Semester Examination

Subject Code: CTMSCS SII P1
Subject Name: Network Security

Date: 17/04/2023

Time: 90 Minutes

Total Marks: 50

Instructions - 1) Answer all questions. 2) Assume suitable data. 3) Scientific Calculator is allowed. 4) Parts of the question should attend the same place.

Q.1	Attempt all.	20 marks
(a)	<p>Consider the above network topology, User A wants to communicate with User B. Explain the explain ARP protocol with respect to this scenario. Further consider User C as the attacker and explain the ARP spoofing in the same topology. Also highlight the all-possible attack vectors and attack surfaces.</p>	5 Marks
(b)	Illustrate ElGamal ECC Encryption algorithm with the example.	5 Marks
(c)	Encrypt the following message using Playfair cipher . Message: jacuzzi Key: jail	5 Marks
(d)	(i) Calculate the power modulo, $191^{930} \bmod 103$. (ii) Find the value of $\Phi(65)$ and $\Phi(99)$.	5 Marks
Q.2	Attempt all.	15 Marks
(a)	Write note on DOS and distributed denial-of-service (DDoS) attacks.	5 marks
(b)	What is the zero point of an elliptic curve?	5 marks
(c)	Explain the differences between error control and flow control.	5 marks
(d)	Define Following terms: (i) Primitive Root (ii) Masquerading (iii) Diffusion (iv) Relatively Prime (v) Avalanche Effect	5 marks

15 Marks

Q.3 Attempt any one.

- (a) Use two global prime number **17** and **31**, the value of **e** is **7** and message **M= 3**, calculate the public key, private key, and the corresponding cipher text. Also prove that RSA decryption is the inverse of RSA encryption.

OR

- Use two global prime number **37** and **43**, the value of **e** is **71** and message **M= 2**, calculate the *public key*, *private key*, and the corresponding cipher text. Also prove that RSA decryption is the inverse of RSA encryption.

08 Marks

- (b) Alice and Bob wish to swap keys by using *Diffie-Hellman* key exchange algorithm and are agreed on prime **p = 23** and base or generator is **g= 5**. Calculate the *secret key* of each user and *shared session key* for both the users. Also explain with the same question that how can Eve (untrusted third person) exploit *Man-in-Middle attack*.

OR

07 Marks

- Alice and Bob wish to swap keys by using *Diffie-Hellman* key exchange algorithm and are agreed on prime **p = 31** and base or generator is **g= 3**. Calculate the secret key of each user and shared session key for both the users. Also explain with the same question that how can Eve (untrusted third person) exploit Man-in-Middle attack.

~~~~END OF PAPER~~~~



**National Forensics Sciences University, Goa Campus**  
**M.Sc. CS - Semester -II**  
**Mid- Semester Examination**

**Subject Code: CTMSSCS SII P1**

**Date: 17/04/2023**

**Subject Name: Network Security**

**Time: 90 Minutes**

**Total Marks: 50**

**Instructions - 1) Answer all questions. 2) Assume suitable data. 3) Scientific Calculator is allowed. 4) Parts of the question should attend the same place.**

|            |                                                                                                                                                                                                                                                                                                                                          |                 |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Q.1</b> | Attempt all.                                                                                                                                                                                                                                                                                                                             | <b>20 marks</b> |
| (a)        | <p>Consider the above network topology, <b>User A</b> wants to communicate with <b>User B</b>. Explain the explain ARP protocol with respect to this scenario. Further consider <b>User C</b> as the attacker and explain the ARP spoofing in the same topology. Also highlight the all-possible attack vectors and attack surfaces.</p> | 5 Marks         |
| (b)        | Illustrate <b>ElGamal ECC Encryption</b> algorithm with the example.                                                                                                                                                                                                                                                                     | 5 Marks         |
| (c)        | Encrypt the following message using <b>Playfair cipher</b> .<br>Message: <b>jacuzzi</b><br>Key: <b>jail</b>                                                                                                                                                                                                                              | 5 Marks         |
| (d)        | (i) Calculate the power modulo, <b><math>191^{930} \bmod 103</math></b> .<br>(ii) Find the value of <b><math>\Phi(65)</math></b> and <b><math>\Phi(99)</math></b> .                                                                                                                                                                      | 5 Marks         |
| <b>Q.2</b> | Attempt all.                                                                                                                                                                                                                                                                                                                             | <b>15 Marks</b> |
| (a)        | Write note on DOS and distributed denial-of-service (DDoS) attacks.                                                                                                                                                                                                                                                                      | 5 marks         |
| (b)        | What is the zero point of an elliptic curve?                                                                                                                                                                                                                                                                                             | 5 marks         |
| (c)        | Explain the differences between error control and flow control.                                                                                                                                                                                                                                                                          | 5 marks         |
| (d)        | Define Following terms:<br>(i) Primitive Root<br>(ii) Masquerading<br>(iii) Diffusion<br>(iv) Relatively Prime<br>(v) Avalanche Effect                                                                                                                                                                                                   | 5 marks         |

|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Q.3</b> | Attempt any one.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>15 Marks</b> |
| <b>(a)</b> | <p>Use two global prime number <b>17</b> and <b>31</b>, the value of <b>e</b> is <b>7</b> and message <b>M= 3</b>, calculate the public key, private key, and the corresponding cipher text. Also prove that RSA decryption is the inverse of RSA encryption.</p> <p style="text-align: center;"><b>OR</b></p> <p>Use two global prime number <b>37</b> and <b>43</b>, the value of <b>e</b> is <b>71</b> and message <b>M= 2</b>, calculate the <i>public key</i>, <i>private key</i>, and the corresponding cipher text. Also prove that RSA decryption is the inverse of RSA encryption.</p>                                                                                                                                                                                                               | 08 Marks        |
| <b>(b)</b> | <p>Alice and Bob wish to swap keys by using <i>Diffie-Hellman</i> key exchange algorithm and are agreed on prime <b>p = 23</b> and base or generator is <b>g= 5</b>. Calculate the <i>secret key</i> of each user and <i>shared session key</i> for both the users. Also explain with the same question that how can Eve (untrusted third person) exploit <i>Man-in-Middle attack</i>.</p> <p style="text-align: center;"><b>OR</b></p> <p>Alice and Bob wish to swap keys by using <i>Diffie-Hellman</i> key exchange algorithm and are agreed on prime <b>p = 31</b> and base or generator is <b>g= 3</b>. Calculate the secret key of each user and shared session key for both the users. Also explain with the same question that how can Eve (untrusted third person) exploit Man-in-Middle attack.</p> | 07 Marks        |

~~~~~END OF PAPER~~~~~

No.: _____

Enrolment No. _____

NATIONAL FORENSIC SCIENCES UNIVERSITY
M.TECH. ARTIFICIAL INTELLIGENCE & DATA SCIENCE
Semester – I – January - 2024

Subject Code: CTMTAIDS SI P3

Date: 16/01/2024

Subject Name: Incident Response and Audit Compliances

Time: 11:00 AM to 2:00 PM

Total Marks: 100

Instructions:

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

| | | Marks |
|-----|---|-------|
| Q.1 | Attempt any three. | |
| (a) | What is an Incident? Explain any 5 types of incident. | 08 |
| (b) | Discuss any 4 types of malwares in detail. | 08 |
| (c) | Discuss the signs of an incident in detail. | 08 |
| (d) | Discuss the process of Post Incident Activities. | 08 |
| Q.2 | Attempt any three. | |
| (a) | Discuss the Preparation phase of Incident Response Management. | 08 |
| (b) | Discuss the Identification phase of Incident Response Management. | 08 |
| (c) | Discuss the Containment and Eradication Phase of Incident Response Management. | 08 |
| (d) | <p>Scenario: On a Saturday afternoon, external users start having problems accessing the organization's public websites. Over the next hour, the problem worsens to the point where nearly every access attempt fails. Meanwhile, a member of the organization's networking staff responds to alerts from an Internet border router and determines that the organization's Internet bandwidth is being consumed by an unusually large volume of User Datagram Protocol (UDP) packets to and from both the organization's public DNS servers. Analysis of the traffic shows that the DNS servers are receiving high volumes of requests from a single external IP address. Also, all the DNS requests from that address come from the same source port.</p> <p>I. Whom should the organization contact, regarding the external IP address in question?</p> <p>II. What precursors of the incident, if any, might the organization detect?</p> | 08 |

| | | |
|-----|-----|---|
| | | <p>III. How would the incident response team analyze and validate this incident? What personnel would be involved in the analysis and validation process?</p> <p>IV. What strategy should the organization take to contain the incident? Why is this strategy preferable to others?</p> <p>V. What additional tools might be needed to respond to this particular incident?</p> |
| Q.3 | | Attempt any three. |
| | (a) | Discuss Incident Response Team Roles, Responsibilities and Structure. |
| | (b) | Write down the importance of Incident Response Policy and Explain key elements of Incident Response Policy. |
| | (c) | Briefly discuss the following terms: ISO/IEC 2700, COBIT, HIPAA, GDPR. |
| | (d) | Explain Project Initiation, Business Impact Analysis, Recovery Strategy Phase of Creating BCP. |
| Q.4 | | Attempt any two. |
| | (a) | Explain Plan, Design & Development, Implementation and Testing phase of Creating BCP. |
| | (b) | You appeared for an interview at TC Ltd. for the position of SoC analyst. The interviewer has asked you to define the following terms: War Room, Threat, Vulnerability, SIEM. Explain each term in your own words. |
| | (c) | Your team has been dealing with an Incident Scenario. There are various different attack scenarios & you have to prioritize the Incident. Explain the team & the organizations how will you prioritize the Incident along with their relevant factors |
| Q.5 | | Attempt any two. |
| | (a) | Write a note on Disaster Recovery Process. |
| | (b) | Write a note on IT Act 2000 and explain any 2 sections of it. |
| | (c) | Write a note on Business Continuity Planning. Why a Business require BCP? |

--- End of Paper---



National Forensics Sciences University, Goa Campus
Mid- semester Examination

Branch – M.Sc. DFIS

Subject Name- Artificial Intelligence

Time- 1.5 Hours

Max. Marks- 50
Instructions - 1) Answer all questions. 2) Assume suitable data.

Sem - II

Subject Code- CTMSDEIS SU B4

Date- 20-04-2023

| Q.1 | | Solve any four | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|--------------------|--|------------|---------|------|-------|-----------|--------|-----|---|-----------|------|-------|---|---------|--------|-----|----|-----------|--------|-------|----|---------|--------|-----|---|--|
| | | a. Derive an expression using vector and matrix form for the linear modelling of $t_n = w_0 + w_1 x_n$, where x_n and t_n represents an input variable and the corresponding output respectively. | 20 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | b. Consider the following set of pair of points (x_n, t_n) : $\{(10, 20), (20, 40), (30, 60)\}$. Find the least square regression line for the given data points and predict the output for $x_n = 40$. | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | c. i. Explain any 3 measures of central tendency.
ii. Explain any two measures used to measure the spread of data. | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | d. Consider an experiment of tossing a fair coin 3 times. Let X be the number of heads obtained in 3 tosses. Answer the following with respect to this experiment.
i. What is the sample space?
ii. What are the values for the random variable X ?
iii. Give the probability of random variable taking on values in its range (Induced probability function)? | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | e. Explain overfitting in machine learning. How can you determine if a model is overfitting? Describe any three ways to avoid overfitting. | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| Q.2 | Attempt all | | 15 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | a. Define instance-based learning. Identify and briefly explain any machine learning model that falls under the category of instance-based learning. | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | b. Discuss in detail the logistic regression model. | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | c. Apply Naïve Bayes classification to the data of fruits provided in the table below to determine the class for the following data input:

Appearance = Undamaged and Quality = Unripe and Size = Small | 5 marks | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Table 1 Fruit Data | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Appearance</th><th>Quality</th><th>Size</th><th>Class</th></tr> </thead> <tbody> <tr> <td>Undamaged</td><td>Unripe</td><td>Big</td><td>I</td></tr> <tr> <td>Undamaged</td><td>Ripe</td><td>Small</td><td>I</td></tr> <tr> <td>Damaged</td><td>Unripe</td><td>Big</td><td>II</td></tr> <tr> <td>Undamaged</td><td>Unripe</td><td>Small</td><td>II</td></tr> <tr> <td>Damaged</td><td>Unripe</td><td>Big</td><td>I</td></tr> </tbody> </table> | Appearance | Quality | Size | Class | Undamaged | Unripe | Big | I | Undamaged | Ripe | Small | I | Damaged | Unripe | Big | II | Undamaged | Unripe | Small | II | Damaged | Unripe | Big | I | |
| Appearance | Quality | Size | Class | | | | | | | | | | | | | | | | | | | | | | | | |
| Undamaged | Unripe | Big | I | | | | | | | | | | | | | | | | | | | | | | | | |
| Undamaged | Ripe | Small | I | | | | | | | | | | | | | | | | | | | | | | | | |
| Damaged | Unripe | Big | II | | | | | | | | | | | | | | | | | | | | | | | | |
| Undamaged | Unripe | Small | II | | | | | | | | | | | | | | | | | | | | | | | | |
| Damaged | Unripe | Big | I | | | | | | | | | | | | | | | | | | | | | | | | |

| Q. 3 | Attempt Q3a and Q3b | 15 marks | | | | | | | | | | | | | | | |
|---------------|--|------------------|--------------|------------------|--|--|--|--------------|--------------|---------------|--------------|------|-----|--------------|-----|-----|--|
| Q.3 a | Attempt any one | | | | | | | | | | | | | | | | |
| Q.3 a | Explain any one unsupervised learning model in detail. List any 5 applications of unsupervised learning model. | 8 marks | | | | | | | | | | | | | | | |
| | OR | | | | | | | | | | | | | | | | |
| Q.3 a | Explain the different types of the machine learning system | 8 marks | | | | | | | | | | | | | | | |
| Q.3 b | Attempt any one | | | | | | | | | | | | | | | | |
| Q3 b | Illustrate with a help of an example the working of a Perceptron model. List a shortcoming of the perceptron model. | 7 marks | | | | | | | | | | | | | | | |
| | OR | | | | | | | | | | | | | | | | |
| Q3 b | Compute the values for True Positive, True Negative, Sensitivity, Specificity, Precision, Recall and F1-Score for the following confusion matrix. | 7 marks | | | | | | | | | | | | | | | |
| | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2"></th> <th colspan="2">Predicted</th> </tr> <tr> <th colspan="2"></th> <th>Rainy</th> <th>Sunny</th> </tr> <tr> <th rowspan="2">Actual</th> <th>Rainy</th> <td>1884</td> <td>437</td> </tr> </thead> <tbody> <tr> <th>Sunny</th> <td>336</td> <td>107</td> </tr> </tbody> </table> | | | Predicted | | | | Rainy | Sunny | Actual | Rainy | 1884 | 437 | Sunny | 336 | 107 | |
| | | Predicted | | | | | | | | | | | | | | | |
| | | Rainy | Sunny | | | | | | | | | | | | | | |
| Actual | Rainy | 1884 | 437 | | | | | | | | | | | | | | |
| | Sunny | 336 | 107 | | | | | | | | | | | | | | |

Seat No.: _____

Enrolment No.: _____

NATIONAL FORENSIC SCIENCES UNIVERSITY**Master of Technology, AI and DS (specialization in Cyber Security)****Semester – I – January – 2024****Subject Code: CTMTAIDS SI P2****Date: 12/01/2024****Subject Name: Network Security And Forensics****Time: 11:00 AM to 2:00 PM****Total Marks: 100****Instructions:**

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Scientific Calculator is allowed.
5. Figures to the right indicate full marks.
6. Parts of the question should be attempted at the same place.

| | | | Marks |
|------------|-----|--|-------|
| Q.1 | | Attempt any three. | |
| | (a) | You are the network administrator of a large organization. Justify the selection of specific internetworking devices to optimize network performance, considering scalability and security concerns. | 08 |
| | (b) | Differentiate between TCP and UDP. Explore potential vulnerabilities and attack scenarios for each protocol. | 08 |
| | (c) | Construct a Playfair cipher for following:
Key: MTECH AIDS
Plaintext: MTECH AI DS is future of NFSU. | 08 |
| | (d) | Provide an overview of SSL/TLS and its role in securing communication over the internet. | 08 |
| Q.2 | | Attempt any three. | |
| | (a) | During live network enumeration, unexpected challenges arise. Describe a specific scenario and outline how you would adapt your live forensics approach to overcome these challenges. | 08 |
| | (b) | Name and briefly describe some tools used for packet sniffing in network security and monitoring. | 08 |
| | (c) | Consider the use of RSA encryption with two distinct prime numbers, where $p=101$ and $q=97$. Additionally, the public exponent is $e=11$. Perform the following operations:
(i) Calculate the RSA public key (e,n) for encryption and determine the corresponding private key (d) for decryption.
(ii) Encrypt the message $M=3$ using the computed public key. | 08 |
| | (d) | Discuss various applications of hash functions in network security and cryptography. Explain any one Hash algorithm. | 08 |

| | | |
|------------|---------------------------|---|
| Q.3 | Attempt any three. | |
| | (a) | Elaborate on the concept of Penetration Testing. Define the Network Pen Testing Life-Cycle and its key phases. |
| | (b) | In an e-commerce platform, a customer purchases an expensive item and later denies making the transaction, attempting to get a refund while keeping the product. How can non-repudiation mechanisms be employed to ensure that the customer cannot falsely repudiate the transaction? |
| | (c) | Describe the role of Public Key Infrastructure (PKI) in the context of digital signatures. |
| | (d) | Alice and Bob decide to use the Diffie-Hellman key exchange algorithm to establish a shared secret key. They agree on the prime modulus $p=31$ and the base or generator $g=11$.
a. Calculate the secret key for both Alice and Bob if Alice's private key is $a=7$ and Bob's private key is $b=9$.
b. Determine the shared session key that Alice and Bob will use for secure communication.
c. Illustrate the step-by-step process of the Diffie-Hellman key exchange algorithm. |
| Q.4 | Attempt any two. | |
| | (a) | Describe the OSCAR Methodology in penetration testing. Provide examples of scenarios where the OSCAR Methodology is particularly effective. |
| | (b) | Assume you are implementing a SIEM tool in a large organization. Describe the steps involved in the implementation process and how the tool enhances the organization's overall security posture. |
| | (c) | Investigate the concept of Evil Twin in wireless networks. Discuss potential threats and countermeasures against such attacks. |
| Q.5 | Attempt any two. | |
| | (a) | During a confidential corporate board meeting conducted over a video conferencing platform, sensitive financial information is discussed. Unbeknownst to the board members, an employee is eavesdropping on the meeting. Discuss the potential consequences of such eavesdropping and propose measures to prevent it. |
| | (b) | Provide an in-depth overview of IEEE 802.11 protocols. Discuss the vulnerabilities associated with WEP and propose alternative security measures. |
| | (c) | Explain following terms:
(i) HTTPS
(ii) IPv6 |

--- End of Paper---

Seat No.: _____

Enrolment No. _____

NATIONAL FORENSIC SCIENCES UNIVERSITY
M.Tech Artificial Intelligence and Data Science (AIDS)
Semester – I– January - 2024

Subject Code: CTMTAIDS SI P1

Date: 11/1/2024

Subject Name: Mathematical and Computational Foundations for Artificial Intelligence

Total Marks: 100

Time: 11:00 AM to 2:00 PM

Instructions:

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

| | | Attempt any three. | Marks |
|------------|-----|---|-------|
| Q.1 | | | |
| | (a) | Define orthogonal matrix. prove that the product of any two orthogonal matrices is also orthogonal. Show that S is a orthogonal set where $S = \{(4,0,0,0), (0,7,0,0), (0,0.8,0), (0,0,0,9)\}$ | 2+3+3 |
| | (b) | I. Define an orthonormal set and prove that $S = \{(1,0,0), (0,1,0), (0,0,1)\}$ is a orthonormal.
II. Define L_1 and L_2 Norm. Find distance between $x=(1,-2,3)$ and $y=(4,6,-5)$ using L_2 Norm. | 4+4 |
| | (c) | Find the condition on b_1 , b_2 , and b_3 such that the systems
$\begin{bmatrix} 1 & 4 & 2 \\ 2 & 5 & 8 \\ -1 & -4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$ are solvable. | 08 |
| | (d) | Define nullspace of a matrix. Compute nullspace for the matrix $C = \begin{bmatrix} 1 & 2 & 4 & 5 \\ 3 & 5 & 7 & 2 \end{bmatrix}$ and two special solution to $Cx=0$. | 08 |
| Q.2 | | Attempt any three. | |
| | (a) | Apply the Gram-schmidt orthogonal process to obtain an orthonormal basis from the basis $B = \{\beta_1, \beta_2, \beta_3\}$ of R^2 where $\beta_1 = (1, -3, 4)$, $\beta_2 = (-4, 6, 8)$, $\beta_3 = (-2, 5, 3)$ | 08 |
| | (b) | Solve the system of equations $x+y+z=1$, $4x+3y-z=6$, $3x+5y+3z=4$ by using LU decomposition. List the importance of LU decomposition over Gauss Elimination method. | 6+2 |
| | (c) | Solve the system of equations $6x_1+18x_2+3x_3=3$, $18x_1+12x_2+15x_3=19$, $3x_1+15x_2+3x_3=0$ by using Cholesky decomposition method. | 08 |
| | (d) | Define Singular value. Find the Singular value decomposition of A
$\begin{pmatrix} 4 & 6 & 8 \\ 5 & 7 & -2 \end{pmatrix}$. | 08 |
| Q.3 | | Attempt any three. | |
| | (a) | Define Simple Linear Regression. How is simple Linear Regression different from Multiple Regression? Write steps to evaluate the regression coefficients of the given set of values $X = [4, 9, 10, 5, 2]^T$ and $Y = [1, 68, 51, 94, 32]^T$. | 2+2+4 |

| | (b) | Define the term (Sum of squared error) SSE, (Mean of squared error) MSE, Root Mean Squared error (RMSE), MAE (Mean Absolute Error) and R2 Error. Explain each term by considering an example. | 08 | | | | | | | | | | | | | | | |
|-----------------|-------------------------|---|-----------------|----------|------|------|------|----|-----|----|---|----|----|---|---|---|----|--|
| | (c) | Why dimensionality reduction method is important in ML. Given the data in Table, reduce the dimension from 2 to 1 using principal component algorithm. | 08 | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Feature</th><th>obs1</th><th>obs2</th><th>obs3</th><th>obs4</th></tr> </thead> <tbody> <tr> <td>X1</td><td>4</td><td>5</td><td>7</td><td>8</td></tr> <tr> <td>X2</td><td>5</td><td>6</td><td>8</td><td>10</td></tr> </tbody> </table> | Feature | obs1 | obs2 | obs3 | obs4 | X1 | 4 | 5 | 7 | 8 | X2 | 5 | 6 | 8 | 10 | |
| Feature | obs1 | obs2 | obs3 | obs4 | | | | | | | | | | | | | | |
| X1 | 4 | 5 | 7 | 8 | | | | | | | | | | | | | | |
| X2 | 5 | 6 | 8 | 10 | | | | | | | | | | | | | | |
| | (d) | Write the steps for Linear discriminant projection for the given 2D dataset
$X_1 = (x_1, x_2) = \{(4,1), (2,4), (2,3), (3,6), (4,8)\}$
$X_2 = (x_1, x_2) = \{(4,8), (6,7), (9,7), (5,10), (8,8)\}$ | 08 | | | | | | | | | | | | | | | |
| Q.4 | Attempt any two. | | | | | | | | | | | | | | | | | |
| | (a) | Differentiate classification from regression. How low dimensional data are reduced into high dimensional data using kernel function in support vector machine. | 07 | | | | | | | | | | | | | | | |
| | (b) | Define polynomial, RBF, ANN kernel function. Minimum marginal distance determines hyper plane in SVM. Justify the answer. | 07 | | | | | | | | | | | | | | | |
| | (c) | Let the positively labeled data points are $\left\{ \begin{pmatrix} 2 \\ 2 \end{pmatrix}, \begin{pmatrix} 2 \\ -2 \end{pmatrix}, \begin{pmatrix} -2 \\ 2 \end{pmatrix}, \begin{pmatrix} -2 \\ -2 \end{pmatrix} \right\}$ and negatively labeled data points are $\left\{ \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \begin{pmatrix} -1 \\ 1 \end{pmatrix}, \begin{pmatrix} -1 \\ -1 \end{pmatrix} \right\}$ respectively. Draw an optimal hyperplane to classify the given data points. | 07 | | | | | | | | | | | | | | | |
| Q.5 | Attempt any two. | | | | | | | | | | | | | | | | | |
| | (a) | In a pack of 52 playing cards, two cards are drawn at random simultaneously. If the number of white cards drawn is a random variable, find the values of the random variable and number of points in its inverse images. | 07 | | | | | | | | | | | | | | | |
| | (b) | i. Define probability density function (pdf). Write the pdf of Gaussian distribution and plot it with specific mean and variance.
ii. Let us define the probability density that a person who is born today assuming that life span is 100 year as $p(t) = 3 \times 10^{-9} \times t^2 \times (100 - t^2)$.

Find the probability that a person die at age t_0 and find the probability that a person will die between the ages 70 to 80. | 07 | | | | | | | | | | | | | | | |
| | (c) | A die is tossed and a random variable x is defined by the amount of won (+) or lost (-) on the face of the die as given in the table. Find the cdf $F(x)$ and pdf $f(x)$. | 07 | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>pips on the die</th><th>win/loss</th></tr> </thead> <tbody> <tr> <td>1,4</td><td>+9</td></tr> <tr> <td>2</td><td>-3</td></tr> <tr> <td>3,6</td><td>-8</td></tr> <tr> <td>5</td><td>+6</td></tr> </tbody> </table> | pips on the die | win/loss | 1,4 | +9 | 2 | -3 | 3,6 | -8 | 5 | +6 | | | | | | |
| pips on the die | win/loss | | | | | | | | | | | | | | | | | |
| 1,4 | +9 | | | | | | | | | | | | | | | | | |
| 2 | -3 | | | | | | | | | | | | | | | | | |
| 3,6 | -8 | | | | | | | | | | | | | | | | | |
| 5 | +6 | | | | | | | | | | | | | | | | | |

--- End of Paper---

ATKT April 2024

Seat No.: _____

Enrolment No. _____

NATIONAL FORENSIC SCIENCES UNIVERSITY

M. Tech AI&DS.
FINAL EXAM - REMEDIAL

Date : 29/4/2024

Subject Code: CTMTAIDS SI P1

Subject Name: Mathematical and Computational Foundation for Artificial Intelligence

Total Marks: 100

Time: 02:00 PM to 05:00 PM

Instructions:

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

| | | Attempt any three. | Marks |
|------------|-----|---|-------|
| Q.1 | | | |
| | (a) | What is Orthogonal Matrix, Define and explain with example. Write any two properties of Orthogonal Set. | 4+4 |
| | (b) | Define an Orthonormal set and prove that $S = \{(1,0,0), (0,1,0), (0,0,1)\}$ is a Orthonormal Determine if the set S is linearly independent. | 2+6 |
| | (c) | Prove that matrix A is Orthogonal and the product of A and A is also orthogonal.
$A = \frac{1}{\sqrt{3}} \begin{bmatrix} -2 & 1 & 2 \\ 2 & 2 & 1 \\ 1 & -2 & 2 \end{bmatrix}$ | 08 |
| | (d) | Define null space. Compute the null space for the following matrix
$D = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and two special solution $Dx=0$ | 2+6 |
| Q.2 | | Attempt any three. | |
| | (a) | Show that the least square solution to a problem $ax = b$ in one unknown is
$\hat{x} = \frac{a^T b}{a^T a}$ | 08 |
| | (b) | Show that slope b_1 of an estimated regression line ($y = b_0 + b_1x$) in simple linear regression model is
$b_1 = \frac{\text{co-variance}(x, y)}{\text{variance}(x, y)}$ | 08 |
| | (c) | What is Single Value and its importance. Find the SVD of the following matrix $A = \begin{pmatrix} 4 & 5 \\ 6 & 7 \end{pmatrix}$ | 2+6 |
| | (d) | Write the Gram-Schmidt algorithm and explain the importance of it. | 6+2 |
| Q.3 | | Attempt any three. | |
| | (a) | Definition of simple linear regression. Purpose and applications of simple linear regression. Assumptions of simple linear regression. | 2+3+3 |

| | | | |
|------------|-----|---|------------------|
| | (b) | How to interpret the slope and intercept of the regression line. How to use the regression line to make predictions. Write steps to evaluate the regression coefficients of the given set of values
$X = [2,4,6,8]^T$ and $Y = [5,7,9,11,13]^T$ | 2+2+4 |
| | (c) | How PCA is used for dimensionality reduction. Explain the relationship between eigenvectors, eigenvalues, and principal components in PCA. | 3+5 |
| | (d) | Define the term (Sum of squared error) SSE, (Mean of squared error) MSE, Root Mean Squared error (RMSE). MAE (Mean Absolute Error) and R2 Error. Explain each term by considering an example. | 08 |
| Q.4 | | | Attempt any two. |
| | (a) | Differentiate classification from regression. How low dimensional data are reduced into high dimensional data using kernel function in support vector machine. | 07 |
| | (b) | Write the steps for Linear discriminate projection for the given 2D dataset
$X_1 = \{(x_1, x_2) = (4,1), (2,4), (2,3), (3,6), (4,8)\}$
$X_2 = \{(x_1, x_2) = (4,8), (6,7), (9,7), (5,10), (8,8)\}$ | 07 |
| | (c) | Define polynomial, RBF, ANN kernel function. Minimum marginal distance determines hyper plane in SVM. Justify the answer. | 07 |
| Q.5 | | | Attempt any two. |
| | (a) | A box contains 5 red balls and 3 green balls. Two balls are drawn at random without replacement. Let X be the number of green balls drawn. Determine the possible values of X and find the number of points in the inverse images of X . | 07 |
| | (b) | Suppose the height of adult male students in a college follows a Gaussian distribution with a mean of 175 cm and a standard deviation of 10 cm. What is the probability that a randomly selected adult male student from this college has a height between 160 cm and 190 cm? | 07 |
| | (c) | Define Projection of a vector on another vector on a three dimensional space. Show that the projection of a vector v on vector u is
$\text{proj}_u v = \frac{uv}{\ u\ } u$ | 07 |

--- End of Paper---

Seat No.: _____

Enrolment No. _____

NATIONAL FORENSIC SCIENCES UNIVERSITY
MSc Cyber Security - Semester - I – ATKT SEE - June -2023

Subject Code: CTMSCS SI P2**Date: 27/06/2023****Subject Name: Cyber Security Audit and Compliance****Total Marks: 100****Time: 11:00 AM to 02:00 PM****Instructions:**

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

| | | | Marks |
|------------|-----|---|--------------|
| Q.1 | (a) | What is Risk in IT environment? | 04 |
| | | OR | |
| | (a) | What is compliance? | 04 |
| | (b) | Brief about the Cyber Security Audit. | 04 |
| | (c) | Write a detailed note on ‘controls’ with its types and selection process. | 08 |
| | (d) | Illustrate the cyber security audit importance in the industry in your words. | 09 |
| | | | |
| Q.2 | (a) | What is the scope of the audit? | 04 |
| | (b) | Discuss the difference between policy and standard. | 04 |
| | (c) | Explain the importance and requirement of security policy and procedure in an organization. | 08 |
| | | OR | |
| | (c) | Explain any real-world case study related to cyber security audit and compliance. | 08 |
| | (d) | Discuss the maximization of C-I-A in Workstation and LAN domain. | 09 |
| | | | |
| Q.3 | (a) | Discuss the Business Impact Analysis. | 04 |
| | (b) | Give brief description about SOC compliance. | 04 |
| | (c) | Write a detailed note on Business Continuity Planning. | 08 |
| | (d) | Write down operations security controls with respect to ISO 27001. | 09 |
| | | OR | |
| | (d) | Explain the process of achieving compliance in an organization. | 09 |
| | | | |
| Q.4 | (a) | What is the Risk Assessment? | 04 |
| | | OR | |
| | (a) | Write list of 7 domains of IT infrastructure. | 04 |
| | (b) | Draw 5 principles of COBIT5. | 04 |
| | (c) | Write the detailed note on HIPAA. | 08 |
| | (d) | Give details of IT Act section 66 and its subsections | 09 |

NATIONAL FORENSIC SCIENCES UNIVERSITY
M.Tech. Artificial Intelligence and Data Science
Semester - I - January - 2024

Subject Code: CTMTAIDS SI P4

Date: 17/01/2024

Subject Name: Fundamentals of Data Science and Machine Learning

Total Marks: 100

Time: 11:00 AM to 2:00 PM

Instructions:

1. Write down each question on separate page.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

| | Marks |
|---|-----------|
| Q.1 | 08 |
| (a) Both k-mean and k-medoids algorithm can perform effective clustering. | |
| a. Illustrate the strength and weakness of k-means in comparison medoids. | |
| b. Illustrate the strength and weakness AGNES clustering schemes. | |
| (b) Determine the Jaccard distance, cosine similarity, and Euclidean distance between the vectors $x = (1, 1, 1, 1)$ and $y = (2, 2, 2, 2)$. Provide definitions for each of these distance measures. | 08 |
| (c) Explain the frequent itemset generation and rule generation in Apriori algorithm. | 08 |
| OR | |
| (c) Visualization additionally gives you sense of data distribution and relationships among variables. Explain different ways of visualizing data. | |
| Q.2 | 08 |
| (a) Consider the following dataset for $k=2$. (3,9), (5,4), (8,7), (9,3), (10,6), (6,8), (4,5), (7,9), (11,5), (12,6). | |
| (b) As a quality control manager in a chocolate factory with three production lines as A, B, and C, instruct the team to construct a decision tree to identify which line is producing counterfeit chocolates and whether they are slightly heavier or lighter than the genuine ones. | 08 |
| (c) Elaborate on the various categories of regression techniques, providing insights into the distinct characteristics of each. | 08 |
| OR | |
| (c) How do Navies contribute to Naive Bayesian Classifiers, and what are the strengths associated with employing the Naive Bayes Classifier? | |

Q.3 (a) Provide an explanation on effectively visualizing hierarchical data with negative values. 08

(b) Given an animal database X: 08

| TID | Items |
|-----|-------------------------------|
| 001 | Cat, Dog, Frog, Goat |
| 002 | Ant, Bat, Cat, Dog |
| 003 | Ant, Cat, Dog, Frog |
| 004 | Cat, Dog, Elephant, Goat, Ant |
| 005 | Ant, Dog, Frog, Bat |
| 006 | Bat, Cat, Goat |
| 007 | Dog, Frog, Goat |
| 008 | Ant, Bat, Goat |

Using the threshold values support = 25% and confidence = 60%.
find:

- All the frequent itemsets in database.
- Strong association rules for database.

(c) Discuss the challenges associated with the fundamental k-Nearest Neighbour algorithm. 08

OR

(c) Provide concise real-world examples illustrating the applications of clustering, classification, and association rule mining in various contexts.

Q.4 (a) How should missing data be addressed in the data cleaning process? 04

(b) Consider the following set of training examples: 05

| Instances | Classification | A1 | A2 |
|-----------|----------------|----|----|
| 1 | + | T | T |
| 2 | + | T | T |
| 3 | - | T | F |
| 4 | + | F | F |
| 5 | - | F | T |
| 6 | - | F | T |

- What is the entropy of this collection of training examples with respect to the target function classification?
- What is the information gain of A2 relative to these training examples?

(c) How can datasets be summarized and what are the various methods employed for this purpose?

OR

(c) For different types of data, calculation of different correlation coefficients is known. Provide a brief with example for each type of data following correlation coefficient are applicable.

- Charles' Spearman's correlation coefficient (r_s).
- Karl Pearson's coefficient of correlation (r_p).
- Chi-square coefficient of correlation (χ^2).

- Q.5**
- (a) Discuss about GIS Data Visualizations. 04
 - (b) Consider the following data for price attribute:
 $\{4,8,9,15,21,24,25,26,28,29,34\}$. Partition the same into bins using:
 - a. Equi-depth binning.
 - b. Smoothing by bin means.
 - c. Smoothing by bin boundaries.05
 - (c) Explain how web social networks can be extracted and analyzed
- OR**
- (c) How to handle the training examples with missing attribute values and differing costs in a decision tree learning

--- Best Of Luck ---

Seat No.: _____

Enrolment No. _____

NATIONAL FORENSIC SCIENCES UNIVERSITY

M.Tech. Artificial Intelligence and Data Science
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|-----|-------------------------------|----|
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| 003 | Ant, Cat, Dog, Frog | |
| 004 | Cat, Dog, Elephant, Goat, Ant | |
| 005 | Ant, Dog, Frog, Bat | |
| 006 | Bat, Cat, Goat | |
| 007 | Dog, Frog, Goat | |
| 008 | Ant, Bat, Goat | |

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OR

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| 4 | + | F | F |
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| 6 | - | F | T |

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- OR**
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