BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Computer Science and Engineering, Term Final (Spring) Examination 2024: Oct 2024 - Nov 2024

Student Group: 106<Earned Credit Hours>108

Subject: CSE 415, Human-Computer Interaction

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use SEPARATE answer scripts for each section.
b. Question-1 in Section-A and Question-5 in Section-B are compulsory.
c. Answer any other TWO out of the remaining THREE questions from each section.
d. Figures in the margin indicate full marks.
e. Assume reasonable data if necessary.
f. Symbols and abbreviations used have their usual meanings.

SECTION-A

Question-1 (Compulsory)

a. Is multi-modality always a good concern for designing digital solution? Justify your answer. **06**

b. As an HCI professional, you are asked to choose an appropriate evaluation method for the following situation: **4+20**
"You have been asked to develop a result processing system for MIST student and would like to test two different designs prior to implementation on prototyping"

You are also asked to identify (with brief justification) the following concerns to conduct the evaluation method for the above situation:

(i) The participants
(ii) The technique used
(iii) Representative tasks to be examined
(iv) Measurements (on evaluation parameters) that would be appropriate
(v) An outline plan for carrying out the evaluation

Question 2

a. Highlights the importance of 'Persona' and 'Scenanios' for design. Provide example of 'persona' and 'scenanio' considering the context of designing an e-learning application for high-school students. **16**

b. What are (i) Auditory Icons and (ii) Earcons? How can they be used to benefit both visually impaired and sighted users? **10**

c. State four characteristics of HCI patterns. **4**

Question 3

a. Depict the Information Architecture (IA) of an e-learning website using the Card Sonling technique. At least 15 construct (card) need to consider to develop the IA. **16**

b. Experts typically achieve lower scores in video games when the sound is muted. Briefly discuss the reasons behind this decrease in performance. **06**

c. Briefly explain the central message of interaction design – ' put the user first, keep the user in the center, and member the user at the end' 08

Question 4

a. Evaluate the following system (any one) based on the seven universal design principles. Simply point out any omitted consideration on principles and suggest ways to enhance the system's universality through redesign. 15

(i) Uniplex System of MIST

OR

(ii) Wireless collar microphone (the one used in your classroom)

b. Define 'commensurate effort'. How this concept associated with 'Recoverability' principle affecting robustness. 05

c. Briefly discuss the following heuristics with examples: 10

(iii) Nielsen's 'user Control and Freedom'

(iv) Norman's 'Design for Error'

SECTION-B

Question 5 (Compulsory)

a. Briefly explain different types of prototyping. In case of each type, how can it be incorporated in the software life cycle? Show using necessary diagrams. 15

b. Suppose you are planning for a tour next year, but you can't choose among India, Singapore, Thailand and Maldives. In case of going to any country from Bangladesh, you have to choose a train instead of plane for India only. So the transportation cost will reduce significantly if you go to India. Again if you want to do shopping, Thailand as well as India will be appropriate whereas you wish to go to Maldives for years because you loves the natural beauty there. So with your limited budget you can stay for only 4 days in Singapore or Maldives. But for the other countries, you can stay at least 10 days. Moreover, in summer, India may not be a good option for you. 10

Design a QOC structure using the appropriate notation so that you can easily make your decision.

c. Write down your understandings about the problems of usability engineering. 5

Question 6

a. Differentiate between Ethnography and Participation Observation. **10**

b. Suppose you are instructed to perform an analysis for your research on your interview taken on 20 participants. All the interviews are recorded on a disk. You are given the video recording and you have to extract the data for prespecified parameters, categorize them and perform the final analysis considering some criteria related to your research. **10**

What type of analysis are you performing? Discuss the advantages of this type of analysis.

c. Write short note on – **5+5**

(i) Validation and verification

(ii) Field study and lab based study

Question 7

a. Suppose you are a user of (the communication s/w) Viber. Message received in Viber is stored in mobiles internal memory. The sending and receiving of messages are managed by a tool-kit name viber-toolbox on your phone and you can see the message on the screen. Now you are reading book online so alternatively that you are not even looking anywhere else. Your friend John has sent you an image via Viber. When the image is received, a notification popped up on the screen with sound and you tap to see it.
Now, show the time lines for various components in the interface using states-event analysis. **20**

b. Explain hoe Concur Task Tree is different than Hierarchical Task Analysis. **10**

Question 8

a. In Spring 2024 semester, you registered for CSE 415 course. For registration, you read the course outline, contracted your advisor and confirmed that you would take the course as the pre-registration steps. After being assigned the course, you completed the payment. Now, it this course you performed several submissions. As there was a term paper submission, you had to form a group, submit their ideas and finalize the idea. To complete the term paper, you conducted a literature review as well as some usability evaluation studies following the methodology. At the end, you summarized the evaluation findings, compiled all data and wrings as a report and submitted via Google classroom. If you wished, you also had a chance to go for publication. **15**

Now construct a Hierarchical Task Analysis and illustrate that using a GHTA.

b. Briefly discuss about the type of plans that can used in a Hierarchical Task Analysis. **8**

c. Write down your understanding about stopping rule while task decomposition. **7**

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B.Sc. in Computer Science and Engineering, Term Final (Spring) Examination 2024: Oct 2024 - Nov 2024

Student Group: 106≤Earned Credit Hours>108

Subject: CSE 433, Artificial Neural Network and Fuzzy Systems

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use SEPARATE answer scripts for each section.
b. Question-1 in Section-A and Question-5 in Section-B are compulsory.
c. Answer any other TWO out of the remaining THREE questions from each section.
d. Figures in the margin indicate full marks.
e. Assume reasonable data if necessary.
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SECTION-A

Question-1 (Compulsory)

a. "Membership Functions are the building block of a Fuzzy System." Justify the statement with examples. **10**

b. Discuss the six types of membership functions with appropriate figures and equations. **10**

c. For a three-inputs one-output Mamdani Fuzzy System, design a conceptual architecture explaining the necessary components. **10**

Question 2

a. Describe the importance of rules in Fuzzy Systems. Mention some strategies in defining the rules of a Fuzzy System. **10**

b. Consider a Fuzzy Inference System with three rules, **20**

Rule1: If x is small THEN y is Medium.
Rule2: If x is Medium THEN y is Large.
Rule3: If x is Large THEN y is Small.

Find the Fuzzy Output for x=4 using Mamdani implication relation.
The Fuzzy variables are defined over a universe [1, 6].
Small = $\left\{\frac{1}{1} + \frac{0.5}{2}\right\}$; Medium = $\left\{\frac{0.3}{1} + \frac{0.6}{2} + \frac{1}{3} + \frac{0.6}{4} + \frac{0.3}{5}\right\}$;
Large = $\left\{\frac{0.4}{4} + \frac{0.7}{5} + \frac{1}{6}\right\}$.

Question 3

a. Let A, B and C be fuzzy sets as, **10**

$A = \left\{\frac{1}{x_1} + \frac{0.4}{x_2} + \frac{0.2}{x_3}\right\}$; Medium = $\left\{\frac{1}{y_1} + \frac{0.5}{y_2}\right\}$;
$C = \left\{\frac{0.1}{z_1} + \frac{0.3}{z_2}\right\}$.
Find the Fuzzy relation $R = A \times B$ & $S = B \times C$.

b. Explain Fuzzy Composition operation for the above (Q3 (a)) Fuzzy Relation R and S, find the Fuzzy Composition as, $T = (R \circ S)$. **10**

c. Justify the statement, "Excluded Middle law does not hold for Fuzzy Set." Provide necessary equations and graphical representation. **10**

Question 4

a. How to design Fuzzy Logic based Regression and Classification Models. Discuss in your own words with an example dataset. **10**

b. Discuss the Key Performance Indicators (KPI) of regression and classification models. Provides necessary equations with examples. **10**

c. Define data preprocessing. Describe five common strategies used for data preprocessing with proper examples. **10**

SECTION-B

Question 5 (Compulsory)

a. Describe five various activation functions with necessary equations and graphical representation. **10**

b. Define the capacity of a perceptron in terms of decision making. Describe necessary equations for weight update by applying the perceptron learning rule. (Hint: $w_{(k)} = w_{(k-1)} + \Delta w_{(k)}$ **10**

c. For a perceptron model, conduct two iterations for its weight updates and validate the learning of the artificial neuron. Apply perceptron learning rule (PLR) based of the following parameters **10**

$\eta = 0.1; \omega = [1, -1, 0, 0.5]^T$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 & -2 & 0 & 1 \\ 0 & 1.5 & -0.5 & 1 \\ -1 & 1 & 0.5 & 1 \end{bmatrix}^T ; \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix} = \begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}$$

Question 6

a Design a perceptron with four inputs using ADALINE Learning rule Derive necessary equations for weight update in a single neuron. **10**

b A super-shop in Bangladesh wants to implement an intelligent fruit sorting machine to do automatic packaging of Mango, Orange, and Apple. Design a neuron model diagram by explaining the design of features, inputs, hidden layers, output and process of learning rule. **20**

Question 7

a Draw the basic architecture of a Single Layer Artificial Neural Network with derivation of equation for learning. **10**

b. Consider the following parameters for a single layer neural network. **20**

$$x = \begin{bmatrix} 1.0 \\ 0.5 \end{bmatrix}, y = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}, w = \begin{bmatrix} 0.5 & 1.0 \\ -1.0 & -0.5 \\ 0.5 & 0.5 \end{bmatrix}$$

Now, calculate the following,

(i) Calculate the loss after first iteration.
(ii) Calculate the updated weight matrix for the first iteration.
(iii) Validate if these is any improvement in the learning.

Question 8

a Describe the advantages and disadvantages of ANN. State an application of ANN as Machine Learning Model applied in our daily life decision making. **10**

b. Explain forward propagation and Back propagation of a multilayer ANN with architectural diagram and corresponding equations. **10**

c. Momentum Learning Strategy can be beneficial over a common Back Propagation Learning. Justify the statement with proper equation and possible output effect of the architecture. **10**

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B.Sc. in Computer Science and Engineering, Term Final (Spring) Examination 2024: Oct 2024 - Nov 2024

Student Group: Earned Credit Hours>108

Subject: CSE 405, Computer Interfacing

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use SEPARATE answer scripts for each section.
b. Question-1 in Section-A and Question-5 in Section-B are compulsory.
c. Answer any other TWO out of the remaining THREE questions from each section.
d. Figures in the margin indicate full marks.
e. Assume reasonable data if necessary
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SECTION-A

Question 1 (Compulsory)

a. A student builds a custom circuit to power a small motor for an automated conveyor belt project. The circuit uses a 12V DC supply and includes components such as the motor, logic circuits and a relay to control the motors operation. The motor runs fine when turned on, but the circuit gets damaged when the relay is turned off. Analyze the cause of this issue and how can this issue be solved. **05**

b. Consider an office set up where a central computer is connected to multiple devices like scanner, printer, and fax machine, all sharing the same communication line. Each device has a different level of priority based on the urgency of its tasks: **15**

- Fax machine has the highest priority
- Printer has medium priority
- Scanner has the lowest priority

In the context of nested interrupt, state the following procedure:

I. The fax machine interrupts the main program and its service procedure runs to complete.
II. The printer interrupts the main program, in turn interrupted by the scanner. After that, both service routines run to completion.
III. The scanner interrupts the main program, in turn interrupted by the fax machine. After that both service procedures run to completion.

c. Suppose three computers are sharing a common SCSI bus among them. Three SCSI controllers are connected to the same bus. Now solve the following scenario and find out the value of t at which all the controllers and buses will become free after executing all the tasks given by all the computers. **10**

Consider, the data transfer rate among all components = 2 sec.
And arbitration + Selection/ reselection = 1 sec.

Initiator	Target	Arbitration time of initiator (sec)	Task time of target given by initiator (sec)
2	3	1	10
1	2	3	8
1	3	6	4
3	1	8	20
3	3	12	9

Question 2

a. Explain the direction of data flow for an IN and an OUT instruction with an example. Demonstrate the basic output interface with an illustration. **10**

b. Program the command byte A for initializing the 82C55 PPI for mode 0 operation, with the following configuration: Port A and Port C_U as input, Port B and Port C_L as output ports. **08**

c. Suppose you want to design a keyboard of a simple electronic calculator. The operands are set by a 2X8 keyboard with 0-9 and +, -, *, /, 'cal'. Now interface the 2x8 keyboard matrix to the 8086 microprocessors using an 82C55 and explain with an example how a keystroke is detected. **12**

Question 3

a. Suppose the following sequence of bits arrives over a link: **05**

11010111110101111100101111101100

Show the resulting frame after any stuffed bits have been removed.

b. Imagine a small law office still using a dot matrix printer for printing carbon copy forms. This printer connects to the offices main computer via a serial port using RS-232 communication, and the communication is managed by a 16550 UART chip, which ensures reliable data transmission and reception. Now write a procedure to transmit the contents of AH to 16550 UART and another procedure to receive data from 16550 UART and return it in AL. Also show the contents of the line status register of 16550 UART **10**

c. Suppose in a pharmaceutical manufacturing company, an automated filling machine will use a stepper motor to control the movement of the filling nozzle. To ensure precise positioning of the nozzle for different vial sizes, the machine should employ half-stepping. Now, design a circuit that interfaces a stepper motor to the 82C55. Also explain the half-stepping operation of the stepper motor. **15**

Question 4

a. In a computer system, a USB device (say a printer) is connected to a USB host. During a high speed data transfer, the host sends a data packet to the printer. However, due to the interference or a temporary disconnection, the printer fails to send the ACK packet back to the host. Explain how can this issue be handled? Write down the format of USB data packet. **10**

b. What is the difference between 'Left hand A' and 'Left hand B' encoding? How can UPC-A barcodes be read as valid EAN-13 barcodes? **05**

c. Assume a barcode data as 027251842047 in UPC. Examine the checksum digit. If it is not correct, provide the correct one. **05**

d. Optical disc can hold a large amount of data. Compared to the magnetic disc, it is less likely to deteriorate over time. Explain the process of accessing information from an optical disc. **10**

SECTION-B

Question 5 (Compulsory)

a. What are the names and states of the pins responsible for DMA read and DMA write operations? What are the modes of operations of Intel 8257? **15**

b. Write a short note about the following: **15**
   i. Semiconductor Temperature sensors
   ii. Thermocouples
   iii. Resistance Temperature Detector

Question 6

a. What is Brain-Computer Interface (BCI), and how does it function? Describe the different types of BCIs. **15**

b. What are a model set register and a status register of Intel 8257? Provide a detailed description of each. **15**

Question 7

a. What is Machine-to-Machine (M2M) communication? What are the key differences between Machine-to-Machine (M2M) communication and the Internet of Things (IoT)? **10**

b. Briefly explain the principles of light dependent sensors. **10**

c. What role does a gateway play in IoT? Explain the differences between fog computing, cloud computing, and edge computing. **10**

Question 8

a. Define an actuator. What are the differences between an actuator and a transducer? **10**

b. Construct a comparative view between the cycle stealing mode and transparent mode of data transfer using the Intel 8257. **10**

c. A major city faces frequent traffic congestion leading to increased pollution, fuel consumption, and travel time. To address this, the city implements an IoT-based smart traffic management system aimed to optimizing traffic flow, reducing congestion, and improving the overall computer experience. Identify the various components required for designing a smart traffic management system and explain how AI can be integrated into this system to enhance its functionality. **10**

BANGLADESH UNIVERSITY OF PROFESSIONALS
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B.Sc. in Computer Science and Engineering, Term Final (Spring) Examination 2024: Oct - Nov 2024

Student Group: 36<Earned Credit Hours ≤ 72

Subject: CSE 429, Computer Security

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use SEPARATE answer scripts for each section
b. Question-1 in Section-A and Question-5 in Section-B are compulsory.
c. Answer any other TWO out of the remaining THREE questions from each section.
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SECTION-A

Question 1 (Compulsory)

a. The CIA Triad forms the foundational framework for computer security. Can you propose some additional concepts that you think necessary in addressing today's advanced cyber security threats? Explain your proposal with appropriate examples. **12**

b. Find out the cryptanalysis attacks for the following cases. Give reasons to defend your answer **9**

i) Eve tricks Alice into decrypting a bunch of ciphertexts that Alice encrypted last month.

ii) Eve picks Alice's encrypted cell phone conversations

iii) Eve has bet Bob that she can figure out the AES secret key he shares with Alice if he will simply encrypt 20 messages for Eve using that key. Bob agrees. Eve gives him 20 messages, which he then encrypts and emails back to Eve.

c. A rotor machine has initial configuration is as follows: **5**

A→F, B→A, C→D, D→E, E→C, F→G, G→B

Find out the configuration after it has encrypted 5 letters.

d. Explain how you can achieve confusion and diffusion. **4**

Question 2

a. Do you think the initial and final permutation in DES are necessary? Why or why not? **6**

b. Explain the meet-in-the-middle attack in DES. How it can be launched? What is the usual way to avoid it? **5**

c. The Double DES uses a cascading of two single DES in its architecture. Propose an alternative architecture that utilizes 112 bit key and two single DES module avoiding meet in the middle attack. **15**

d. Explain why bit independence criteria is an important for S-boxes. **4**

Question 3

a. Design a simple Fiestel cipher that includes a non-invertible component. Show your cipher can be used for decryption also using the same architecture used in encryption. **8**

b. Diiferentiate between computational and unconditional security. Describe a cipher that achieves perfect secrecy. **2+5=7**

c. Encrypt the word 'Encryption' using a playfair cipher with the word 'Secret' as a key. **5**

d. Discuss the security feature of Playfair cipher. Design a modified Playfair cipher that can use quadgram (four consecutive letters) as a unit of encryption. **10**

Question 4

a. Compare the features of DES and AES. How are the rounds in AES determined using plaintext size and key size. **6**

b. What is $GF(2^8)$? Perform addition and multiplication operations between two numbers ED_{16} and $3A_{16}$ in $GF(2^8)$ using prime polynomial $m(x) = x^8 + x^4 + x^3 + x + 1$ **10**

c. Draw the basic structure of AES. Also explain the key expansion process in AES **10**

d. Find out the inverse permutation of the following permutation table **4**

8	7	3	9	5	2	4	1	6

SECTION-B

Question 5 (Compulsory)

a. Explain how an attacker can conduct man-in-the-middle attack in a Diffie-Hellman key exchange algorithm. Draw the scenario where private key of the two parties trying to communicate are 4 and 5, and the prime number and generator of the prime number used by the attacker are 13 and 6, respectively. **12**

b. Analyze the applicability of Hash function for achieving message authentication. If you think that it provides message authentication, then explain how it does that. If you think that it does not provide message authentication, then explain different ways to achieve message authentication while using Hash function. **12**

c. Describe Fileless Malware and identify its key characteristics by which it remains evasive against antivirus software. **6**

Question 6

a. Describe the desired characteristics of a Cryptographic Hash Function to restrict its manipulation by a hacker. **7**

b. Describe and justify the use of 'station to station Key Agreement' algorithm to prevent man-in-the-middle attacks in case of Diffie-Hellman key exchange algorithm. **7**

c. Explain the importance of understanding Cyber kill Chain to protect against cyber-attacks. Describe kill chain scenario narrating attacker's objective and defender's action in case of Distributed Denial of Service (DDoS) attack. 12

d. What is the number of padding bits in case of SHA-512 hash algorithm if the length of original message is 3276 bits? 4

Question 7

a. Justify the statement "MAC is a keyed hash function". 5

b. Describe the data authentication algorithm CMAC (Cipher-based Message Authentication Code) using a block diagram. 10

c. Illustrate the gravity of Advanced Persistant Threat (APT) in the context of cyber security. Do you consider the billion-dollar Bangladesh Bank heist as APT? What are the key characteristics of APT evident in this incident? 10

d. Draw and describe Biometric Measurement operating characteristic curve 5

Question 8

a. Evaluate the use of RSA algorithm in the Digital Signature scheme. Use the prime numbers 17, 13 to find out public and private key pair. Verify the deduced key using an arbitrary message value 6. 12

b. Show different components of Digital Signature Algorithm (DSA/DSS) using a diagram. 5

c. Describe and justify the use of Lampart one-time password technique in Entity authentication. 8

d Describe Cryptojacking and the reason of its increasing threat in cyber space. 5

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B.Sc. in Computer Science and Engineering, Term Final (Spring) Examination 2024: Oct 2024 - Nov 2024

Student Group: Earned Credit Hours > 108

Subject: GEEM 433, Engineering Ethics and Moral Philosophy 120

Time: 3.00 hours **Full Marks:** 180

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
d. Figures in the margin indicate full marks.
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SECTION-A

Question 1 (Compulsory)

a. What does Ethics mean to you? Compare moral reasoning to social responsibility with examples. **10**

b. According to Social Contract Account, "Professionals have an implicit agreement with public" – how? Justify your answer. **10**

Question 2

a. How can the engineers improve well-being through design? Briefly discuss with examples. Discuss Valor's three (03) Commination Virtues. **10**

b. Discuss the effect of Technology on social relationships and Generations with example. Define Technological Optimism and Pessimism. **10**

Question 3

a. What are the components of moral issues? Explain the three (03) claims about the factual issues. **10**

b. Discuss four (04) types of Moral Judgments with examples. Explain Ross's Prima Facia Duties and its relation with engineering profession. **10**

Question 4

a. Explain the three (03) levels of Generality (Moral Statement). **10**

b. List the criteria for using cadavers in crash test and its conclusion drawn from the Mannequins and Cadavers. **10**

SECTION-B

Question 5 (Compulsory)

a. List the Fundamental Cannons of code of Ethics for Engineering's, (NSPE). "Engineers shall act for each employee or client as faithful agents or trustees" – Elaborate your answer with examples. 10

b. Define Philosophy of Engineering. Discuss the four concepts of philosophy: 10
(i)Epistemology (ii) Metaphysics
(iii)Logic (iv)Axiology

Question 6

a List three approaches to the Utilitarian Model. In applying the "Cost benefit Test of Utilitarian Approach- what steps should be taken? 10

b. Explain the "Test of Maximizing Good Consequences. Why is the "Rules and Practice Test" important? 10

Question 7

a. Define Common Morality. Discuss the Golden Rule test and steps required to apply the test in satisfying the RP model Standard. 10

b. Define Conflict of Interest and explain the relationship between Code of Ethics and Conflict of Interest. 10

Question 8

a. Define Ethical Dilemmas. What are the Challenges for CSE Engineers with the advancement of Technology? 10

b. What is whistleblowing? Explain the following (Richard DeGeorge Model): 10
(i)Morally Justified
(ii)Morally Obligatory