ASSESSMENT FRAMEWORK AND MODEL QUESTION PAPER

COMPUTER SCIENCE

Grade XII

NATIONAL CURRICULUM OF PAKISTAN
2022-23

SCHEME OF STUDIES 2009

FEDERAL BOARD
OF INTERMEDIATE AND SECONDARY EDUCATION, ISLAMABAD

WE WORK FOR EXCELLENCE

FEDERAL BOARD OF INTERMEDIATE AND SECONDARY EDUCATION

H-8/4, ISLAMABAD

ASSESSMENT FRAMEWORK

FOR

COMPUTER SCIENCE GRADE-XII

CURRICULUM 2022-23

SCHEME OF STUDIES 2009

ACKNOWLEDGEMENT

It is a great honour that we, at the Federal Board of Intermediate and Secondary Education, have developed the Assessment Framework (AF) for the subject of Computer Science for Grade-XII. The primary objective of the AF is to optimize the current curriculum 2022-23. This comprehensive framework has been crafted meticulously by subject matter and assessment experts who conducted an in-depth review of all learning outcomes for Grade-XII Computer Science curriculum. They evaluated these outcomes in terms of their scope, cognitive level, and progression across the grade.

This significant undertaking was the result of a series of extensive meetings and collaborative efforts of the subject and assessment experts. Their dedication and expertise have been instrumental in bringing this framework to fruition.

The Assessment Framework will serve as a guiding document for students, teachers and paper setters. Students will receive clear directions for preparing themselves for the annual examination. Similarly, teachers will use it as a guide to understand what to teach in class and to prepare students for the final examinations accordingly. Similarly paper setters will also seek guidance from this document.

Following subject as well as assessment experts/committee members remained constantly engaged in the development of the AF:

1. Ms. Rozina Faheem, Principal, F G College of Home Economics and Management Sciences, F-11/1 Islamabad
2. Ms. Sadaf Zehra Kazmi, Associate Professor, Islamabad Model College for Girls (PG), F-7/2, Islamabad
3. Ms. Sadia Mujtaba, Assistant Professor, Islamabad Model College for Girls, I-8/4 Islamabad
4. Mr. Saghir Ahmed, Lecturer, Islamabad Model College for Girls, St# 25, F-6/2 Islamabad

The whole work was successfully accomplished under the able supervision and guidance of Dr. Ikram Ali Malik, Chairman, FBISE and due to the hard work and dedication of the staff of Research Section of FBISE, in particular, Syed Zulfiqar Shah, Deputy Secretary, Research and Academics who played a pivotal and leading role in finalizing the Assessment Framework.

MIRZA ALI
Director (Test Development)
FBISE, Islamabad

ASSESSMENT FRAMEWORK FOR COMPUTER SCIENCE GRADE-XII, CURRICULUM 2022-23

To ensure clarity and precision in assessment, the learning outcomes have been categorized into two distinct groups: formative and summative. This classification helps in effectively measuring student progress and understanding. Each Student learning outcome (SLO) has been carefully marked as either formative or summative within the newly developed Assessment Framework. SLOs of Summative Assessment Format will be part of the Final Examination while SLOs of Formative Assessment will although be part of the teaching-learning activity but they will **NOT** be part of Final Examinations. Estimated cognitive levels i.e Knowledge (K), Understanding (U) and Application (A) of all the SLOs have also been indicated. It may be noted that all the higher cognitive levels have been collectively accumulated in the cognitive level of 'Application'. In subjects involving Practicals (Lab work), it has been mentioned categorically whether an SLO is summative for theory or summative for Practical Based Assessment (PBA). If an SLO is summative for PBA, it means that Laboratory work is required in the teaching-learning activity and it will be part of the Practical Examination/ Practical Based Assessment.

The Assessment Framework will act as a comprehensive guide for students, teachers and paper setters. Students will have clear instructions on how to prepare for the annual examinations. Teachers will use the framework to understand the curriculum and effectively prepare their students for the final examination. Additionally, paper setters will refer to this document for guidance in setting examination papers.

A model question paper has also been developed to provide a clear structure and format for upcoming examinations. The model question paper ensures consistency and fairness, offering students a comprehensive understanding of what to expect in their examinations. By aligning the paper with the Student Learning Outcomes (SLOs) of the curriculum, we ensured that the questions accurately reflect the skills and knowledge that students are expected to acquire.

A detailed Table of Specifications (ToS) has been created to ensure equitable coverage of cognitive levels and content domains in order to generate a balanced question paper. The ToS serves as drawing scale and action plan for the question paper, ensuring that all important areas of the curriculum are adequately and proportionately assessed.

FORMATIVE ASSESSMENT: AN ESSENTIAL COMPONENT OF EFFECTIVE LEARNING

Formative assessment is a pivotal element in the educational process, distinguished by its role in providing ongoing feedback to both students and educators. Unlike summative assessments, which evaluate student learning at the end of an instructional period, formative assessments are integrated into the learning process to monitor student understanding and guide instructional decisions.

The primary objective of formative assessment is to identify learning gaps and misunderstandings as they occur, enabling timely interventions. This dynamic approach allows teachers to adjust their teaching strategies to better meet the needs of their students. For instance, if a teacher notices through a quick quiz or class discussion that a significant portion of the class struggles with a particular concept, they can revisit that topic, providing additional explanations or alternative methods of instruction. This adaptability is crucial for fostering a deeper understanding of the material.

Formative assessments come in various forms, ranging from informal methods like classroom discussions, observations, and questioning, to more structured approaches such as quizzes, peer assessments, and self-reflections. These methods are not limited to paper-and-pencil tasks but can include digital tools that provide instant feedback. The versatility of formative assessments allows educators to cater to diverse learning styles and preferences, ensuring that all students are engaged and supported in their learning journey.

Formative assessment plays a significant role in creating a supportive classroom environment. It shifts the focus from merely achieving grades to understanding the learning process. This approach reduces the pressure on students, as they perceive assessments not as a final judgment of their abilities but as a part of their learning journey. Consequently, formative assessment can lead to increased student motivation and engagement.

In conclusion, formative assessment is a powerful tool that, when effectively implemented, can significantly enhance the learning experience. It provides invaluable insights for both teachers and students, promotes a growth-oriented learning environment, and supports the continuous development of essential skills. As education evolves, the role of formative assessment will undoubtedly continue to be central in fostering successful and meaningful learning experiences.

SUMMATIVE ASSESSMENT: EVALUATING LEARNING OUTCOMES IN THE FORM OF TERMINAL/FINAL EXAMINATION

Summative assessment is a fundamental component of the educational process, designed to evaluate student learning at the conclusion of an instructional period. Unlike formative assessment, which provides ongoing feedback during the learning process, summative assessment serves as a final measure of what students have learned. Typically administered at the end of a unit, course, or academic year. Summative assessment aims to determine the extent to which educational objectives have been achieved.

The primary purpose of summative assessment is to assess the overall effectiveness of instruction and learning. It provides a conclusive evaluation of student performance, often in the form of tests, final projects, or standardized exams. These assessments generate grades or scores that reflect a student's achievement in a given subject area over a specific period or time duration.

Summative assessment is often used to make critical decisions regarding student progression, certification, or placement in subsequent educational levels. Additionally, summative assessments provide valuable data that inform curriculum development and instructional strategies. By analyzing summative assessment results, educators can identify trends, strengths, and weaknesses within their instructional approaches, allowing for improvements in future teaching.

In conclusion, summative assessment plays a critical role in the educational process by providing a final evaluation of student learning. While it differs from formative assessment in its focus and application, it is an essential tool for measuring academic achievement. When balanced with formative assessments, summative assessments contribute to a well-rounded and effective approach to evaluating and supporting student learning.

National Curriculum of Pakistan 2022-23

Assessment Framework

COMPUTER SCIENCE Grade-XII (HSSC-II)

Details of Content Areas/ SLOs

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
A: Computer Systems	**[SLO CS-12-A-01]** Students will explain the usability, security and accessibility of devices, the systems they are integrated with. Students will understand… • What is the usability and accessibility of software applications • Human-computer interaction is a field of study to promote efficient, effective and satisfying user interactions • The effects of not building accessible applications can be far reaching • How design can make interfaces effective and user friendly • How design can affect a wide range of accessibility issues Students will know • What usability testing is and how to design accessible user interfaces • The effects of not building accessible applications can be far reaching Students will be able to • Understand the social, ethical, economic and environmental implications of bad software and system design	Summative for Theory	Knowledge/ Understanding/ Application	Question(s) will be asked in the Annual theory paper	**30**
	[SLO CS-12-A-02] Explain human interaction with computer systems in terms of: • Usability • Common problems • Methods for improvements • Ethical, social, economic, and environmental implications Students will understand that • Human-computer interaction is a field of study to promote efficient, effective and satisfying user interactions Students will know • What usability testing is and how to design accessible user interfaces	Summative for Theory	Knowledge/ Understanding/ Application	Question(s) will be asked in the Annual theory paper	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	[SLO CS-12-A-03] Identify and explain tradeoffs between the usability and security of computing recommend cybersecurity measures by considering different factors such as efficiency, cost, privacy, and ethics Students will understand that • There are tradeoffs between making a system more secure vs. making it more usable • What the factors are around efficiency, cost, privacy and ethics when it comes to cybersecurity • Both security and user experience are essential features for any software system Students will know • How to implement basic cybersecurity measures that take usability into account • What is a zero-trust approach and how to design for it Students will be able to • Explain the tradeoffs between security and usability • Understand how to consider data privacy and security when designing an application • Design ways to simplify app security(e.g. simplified1-click authentication, design for transparency etc.) so the experience is more seamless • Balance security design of application such that efficiency, cost, privacy and ethics are not compromised	Summative for Theory	Knowledge/ Understanding/ Application	Question(s) will be asked in the Annual theory paper	
B: Computational Thinking and Algorithms	**[SLO CS-12-B-01]** Understand and evaluate the computational solutions in terms o efficiency, clarity, and correctness	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	**20**
	[SLO CS-12-B-02] Understand and apply complex algorithms on data structures such as trees and binary search Students will know that • Define data structures such as lists, arrays, trees stack, and queue • How to traverse a tree	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	• In-order Traversal • Pre-order Traversal • Post-order Traversal • How to conduct a binary search • Application of tree data structure • Application of binary search algorithm				
C: Programming Fundamentals	**[SLO CS-12-C-01]** Students should be able to understand and evaluate applications of various programming paradigms Students will understand… • The purpose of programming language paradigms is to reduce complexity and make code easy to understand for programmers • A high-level view and pros/cons of Object-Oriented Programming • A high-level view and pros/cons of functional programming Students will be able to… • Write a Python program using Object Oriented Programming to define a class with instance attributes to manage states	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	**40**
	[SLO CS-12-C-02] Students should be able to use more advanced programming constructs such as data structures (lists etc.), file handling (disk 10 to write to storage), and databases in Python. Students will understand… • The purpose of a list is to store an ordered list of elements • What is the importance of disk I/O? • File handling methods and file operations (Create, Read and Write, etc.) • The purpose of a dictionary is to store key-value pairs • Given a key, finding a value in a dictionary is faster than in a list • What is the use of database • Introduction to a database tool (e.g. MS Access, MySQL, etc) • Data normalization up to third form • Primary key, secondary key, etc • How to connect databases with python programming	Summative for Theory and Practical Based Assessment	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper as well as Lab work will be assessed in the Practical Based Assessment	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	Students will be able to… • Write and execute programs to create and add/remove items in a list in Python • Construct and retrieve values from a dictionary in Python • Write and execute programs that create and writes to the file • Read existing files • Create and manage database in Python • Create & update tables • Data normalization up to third form • Select from tables (How to add, delete and edit records) • Select with filter (where statement) • Sort results (Order by statement)				
	[SLO CS-12-C-03] Students should be able to implement complex algorithms that use lists etc. in Python Students will understand… • The concept of a nested list (list within a list) • A list as a value within a dictionary Students will be able to… • Write, execute and debug a Python program that reads a text file from disk and prints the number of occurrences of each letter of the alphabet	Summative for Practical Based Assessment	Understanding/ Application	Question(s) will be asked in the Practical Based Assessment	
	[SLO CS-12-C-04] Students will determine more advanced techniques (unit tests, breakpoints, watches) for testing and debugging their code in Python Students will understand… • The purpose of a unit test • Debugging allows programmers to analyze code as it runs Students will be able to… • Write a unit tests for the functions in their code • Use a print statement to help debug bugs in their code	Summative for Practical Based Assessment	Understanding/ Application	Question(s) will be asked in the Annual Practical Based Assessment	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
D: Data and Analysis	**[SLO CS-12-D-01]**Students will be able to analyze data and identify key model performance metrics of real-world machine learning models. Students will understand… • The difference between machine learning and rule-based algorithms • The basics of machine learning model building, i.e., feature engineering, train-test split and model assessment • They will learn how "learning from the data" works and which algorithms fit which data structures best. • The difference between predictive outcomes vs. causality Students will be able to… • Apply machine learning to a real-world problem(using Excel, Python, or R, Jupypter notebooks etc.) • Interpret the results of the model output including features with most impact • Assess models with metrics appropriate for the algorithm type and improve on the model using hyper parameter tuning	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	**25**
	[SLO CS-12-D-02] Students will explain and create a data visualization using Structured Query Language (SQL), or Python, or R Students will know… • Data storytelling • read and critique published data stories and visualizations • How to formulate questions, identify existing data sets, and evaluate how the new data stories compare against the old Students will know • Techniques of descriptive statistics, to construct multiple views of data to uncover new insights Students will be able to • Identify their own dataset from the internet or known surveys • Use R or Python to create visualization	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	[SLO CS-12-D-03] Students will learn how to form hypotheses and perform hypothesis testing. Students will learn to communicate findings using advanced data visuals and tie them back to hypotheses. Students should be able to understand • P-values and significance testing • Null and Alternative Hypothesis • Concepts and definitions of hypothesis testing Students will know about • Simple hypothesis testing • P-values and significance tests and making conclusions using statistics Using visuals to support hypothesis Students will be able to… • Compare a P-value to a significance level to make a conclusion in a significance test • Write a null and alternative hypothesis • Estimate a P-value from a simulation • Use P-value to make a conclusion • Draw a visual graph/bar chart or histogram to tie it back to the conclusion	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	
E: Applications of Computer Science	**[SLO CS-12-E-01]** Students should be able to design ideas of applications relevant to Pakistan using 10T, Cloud computing, and Blockchain Students will understand… • That IoT applications are applicable to Pakistan be able to come up with ideas on what applications are needed in the community	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	**15**
	[SLO CS-12-E-02] Students should be able to describe deep learning and its applications Students will understand… • The relationship between neural networks and deep learning networks • The deep learning networks help us extract features from a given dataset • Identify applications of neural and deep learning networks	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	[SLO CS-12-E-03] Students should be able to assess policies that can help protect different stakeholders' interests **[SLO CS-12-E-04]** Students should be able to evaluate scenarios with data sharing and privacy conflicts and suggest policy decisions that can help achieve acceptable compromises. Students will understand… • Data sharing and privacy have conflicting requirements • Each policy decision with conflicting interests requires compromises. Students will be able to… • Think critically about data sharing and privacy conflicts and develop the ability to evaluate different perspectives and arguments • Articulate their viewpoints and respond to opposing views. They will also develop their ability to express complex ideas and information in a clear and concise manner. • Collaborate, communicate, and negotiate with one another • Suggest policy decisions to mitigate data sharing and privacy conflicts	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	
F: Impacts of Computing	**[SLO CS-12-F-01]** Identify and apply safe practices when collaborating on digital or online platforms Students will understand… • The necessity of security protocols for secure storage and transmission of data • When and how their information is collected and used • Giving away private information can make it easier for your identity to be stolen Students will know… • Different types of cyber attacks:DDoS attack, ransomware, spyware, viruses, phishing • Different security methods used: 2FA, biometric verification • Basics of cryptography and the common ciphers used for safe transmission of data Students will be able to…	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	**15**

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	• Apply basic security methods to computing applications they create • Evaluate the kinds of security protocols being used by different computing systems and devices • Identify security threats in the use of different computing applications and devices • Troubleshooting issues to support security of systems and applications • Find a cyber security threat and be able to apply strategies to correct it				

	[SLO CS-12-F-02] Discuss security threats and mitigation such as 2FA, biometric verification, and secure techniques for transmitting data etc.
	Students will understand…
	• The necessity of security methods for the storage and transmission of data
	  ○ Different security methods used: 2FA, biometric verification
	  ○ Basics of cryptography and the common ciphers used for safe transmission of data
	• When and how their information is collected and used
	• Giving away private information can make it easier for your identity to be stolen
	Students will know…
	• Different types of cyber attacks:DDoS attack, ransomware, spyware, viruses, phishing etc.
	Students will be able to…
	• Apply basic security methods to computing applications they create
	• Evaluate the kinds of security protocols being used by different computing systems and devices
	• Identify security threats in the use of different computing applications and devices
	• Trouble shooting issues to support security of systems and applications
	• Find a cyber security threat and be able to apply strategies to correct it
		Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	

Content Domain/ Area	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
	[SLO CS-12-F-03] Collaborate on strategies to provide equity and equal access to information Students will understand… • The need to develop computational perspectives that are valuable for their future career • The need for collaborations to improve designs of computing applications	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	
G: Digital Literacy	**[SLO CS-12-G-01]** Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools. Students will understand… • How to perform advanced searches to location information a research topic Students will know… • How to use digital tools to communicate results and conclusions Students will be able to… • Perform advanced searches to locate information • Create an artifact that answers a research question, communicates results and conclusions through digital resources or tools	Summative for Theory	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper	**10**
H: Entrepreneurship in the digital age	**[SLO EN-12-H-01]** Students will create and test a minimum viable product for their business Students will understand… • What is minimum viable product (MVP) • Difference between MVP and prototype • What is the Riskiest (Business Model) assumption and how to identify it • How to design a test using an MVP • How to identify "beachhead market" for MVP testing Students will be able to… • Design, create, and test an MVP for a business idea for their beachhead market	Summative for Theory and Practical Based Assessment	Knowledge / Understanding/ Application	Question(s) will be asked in the Annual theory paper as well as Lab work will be assessed in the Practical Based Assessment	**10**

Note: PBA STANDS FOR "PRACTICAL BASED ASSESSMENT"

Federal Board HSSC-II Examination
Computer Science Model Question Paper
(Curriculum 2022-23) Scheme of Studies 2009

ROLL NUMBER					
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Section - A (Marks 13)

Time Allowed: 20 minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. *Do not use lead pencil.*

Candidate Sign._____ **Invigilator Sign. _____**

Q1. Fill the relevant bubble against each question according to curriculum. Each part carries one mark.

Sr#	Question	A	B	C	D	A	B	C	D
i.	Which is an example of a usability-security tradeoff?	Short passwords for convenience	Strong passwords with auto-login	Complex passwords boost security but hinder recall.	Weak passwords with auto-login	○	○	○	○
ii.	How can a company improve website usability?	More ads for revenue	Usability testing and design improvements	Requiring user accounts for access	Removing multimedia content	○	○	○	○
iii.	What is the main advantage of a binary search over a linear search?	Binary search works on both sorted and unsorted data	Binary search has a time complexity of O(n)	Binary search reduces the search space by half at each step	Binary search does not require comparisons	○	○	○	○
iv.	A binary search tree (BST) contains the numbers **50, 30, 70, 20, 40, 60, and 80.** What will be the output of an in-order traversal?	50, 30, 20, 40, 70, 60, 80	20, 30, 40, 50, 60, 70, 80	50, 70, 30, 60, 80, 20, 40	30, 20, 40, 50, 70, 60, 80	○	○	○	○
v.	Which of the following is a primary benefit of Object-Oriented Programming (OOP)?	It avoids the use of functions	It encourages reusable and modular code	It eliminates the need for variables	It runs faster than all other paradigms	○	○	○	○
vi.	What is a significance level **(α)** in hypothesis testing?	The probability of rejecting the null hypothesis when it is true	The probability of accepting the null hypothesis when it is false	The sample size used in the test	The standard deviation of the population	○	○	○	○
vii.	What will be the precision of a trained machine learning model having the following confusion matrix? **Predicted Positive** / **Predicted Negative** **Actual Positive**: 90 / 10 **Actual Negative**: 30 / 70	90%	75%	70%	60%	○	○	○	○

viii.	Why is it essential for businesses to implement data protection policies?	To ensure all business data is kept offline	To prevent data breaches and unauthorized access	To allow unrestricted data access for all employees	To eliminate the need for user authentication	○ ○ ○ ○
ix.	What actions should be taken to enhance the model's performance?	Increase the number of hidden layers in the neural network	Use blockchain for storing patient records	Limit training to only a small number of images	Avoid using labeled datasets	○ ○ ○ ○
x.	Which security method is commonly used to protect sensitive online transactions?	Biometric authentication	HTTP protocol	Plain text storage of passwords	Open access networks	○ ○ ○ ○
xi.	Which of the following is a key step in conducting an advanced online search?	Entering a single-word search term	Using Boolean operators like AND, OR, and NOT	Clicking on the first link that appears in a search engine	Relying only on social media for research	○ ○ ○ ○
xii.	How do digital tools enhance the communication of research findings?	They help present data visually and improve clarity	They eliminate the need for research validation	They restrict access to findings	They replace the need for critical analysis	○ ○ ○ ○
xiii.	What role does the "riskiest assumption" play in refining an MVP?	To create a product without any flaws	To validate the most critical factor that could impact the business model’s success	To minimize production costs	To increase marketing efforts	○ ○ ○ ○

Federal Board HSSC-II Examination
Computer Science Model Question Paper
(Curriculum 2022-23) Scheme of Studies 2006

Time allowed: 2.40 hours | Total Marks: 62

Note: Answer all parts from Section 'B' and all questions from Section 'C' on the **E-sheet**. Write your answers on the allotted/given spaces.

SECTION – B (Marks 42)

Q.2	Question	Marks		Question	Marks
i.	What is usability testing, and how does it help improve user experience?	1+2	OR	What is the purpose of train-test split in machine learning model building?	3
ii.	How is the binary search algorithm useful in searching large datasets efficiently? Give any three (03) key points.	3	OR	What is phishing, and how can users protect themselves from phishing attacks?	1+2
iii.	Perform the In-order traversal and write the correct sequence of node visits for the following tree: 	3	OR	A corporate office restricts work to company devices for security, but employees find it limiting. What alternative measures can balance security and flexibility?	1.5+ 1.5
iv.	What is feature engineering, and why is it important in machine learning?	1+2	OR	What is the purpose of cryptography in data security? Enlist any two (02) commonly used ciphers.	1+2
v.	Why is human-computer interaction (HCI) important in software and device design? Justify your answer with three (03) valid reasons	3	OR	How online sharing of sensitive information can lead to identity theft? Support your answer with a real-world example.	1+2
vi.	Convert the following table from Second Normal Form (2NF) to Third Normal Form (3NF). OrderID, CustomerName, CustomerCity, ProductID, ProductName, Quantity 101, Ahmed Khan, Karachi, P001, Laptop, 2 101, Ahmed Khan, Karachi, P002, Mouse, 1 102, Sana Baloch, Lahore, P001, Laptop, 1 103, Bilal Ahmed, Islamabad, P003, Keyboard, 3	3	OR	Consider the following table and write the output of the following SQL queries: a) SELECT * FROM employees WHERE department = 'IT'; b) SELECT AVG(salary) AS average_salary FROM employees; E_id, name, D_id, department, salary 1, Ali, 100, IT, 80000 2, Sara, 101, HR, 60000 3, Ahmed, 102, Finance, 90000 4, Ayesha, 100, IT, 85000 5, Bilal, 103, Marketing, 70000	1.5+ 1.5
vii.	What are three important factors to consider when implementing cyber security measures?	3	OR	What are the key steps involved in building a machine-learning model?	3
viii.	How can a balance between usability and security be maintained in digital devices?	1.5+1.5	OR	How do we assess the effectiveness of a computational solution?	3
ix.	A company needs to store hierarchical employee data. Which data structure would you recommend, and how would you apply it?	1+2		Here is the sample data in table format: Student ID, Name, Grade 101, Ali, 85 102, Babar, 90 103, Sana, 78 Use this data to compare storage and retrieval using a nested list and a dictionary in context to Python.	1.5+ 1.5
x.	Give a real-world example of how tree data structures are used in computing.	3	OR	A team is working on a research project and wants to visually present their conclusions. Which digital tool could they use, and why?	1+2
xi.	How can collaboration improve the design of computing applications for diverse users? Provide any three (03)	3	OR	A search engine needs to quickly find a keyword from a sorted list of millions of	1+2

	reasons.			words. Which algorithm would be most efficient, and how does it work?	
xii.	How can digital tools help in effectively communicating research findings? Provide one (01) example.	2+1	OR	What challenges do companies face when ensuring both data security and user privacy? (any three 03)	3
xiii.	What is deep learning and traditional machine learning?	1.5+1.5		Write down any three (03) benefits of data visualization in making data-driven decisions?	3
xiv.	A university is offering online courses to students worldwide. How can cloud computing enhance accessibility and performance?	3	OR	A visually impaired user struggles to navigate a website due to small text and poor contrast. How can improving usability and accessibility make the website more user-friendly?	3

SECTION – C (Marks 20)

Note: Attempt all questions. Marks for each question are given. (4 x 05=20)

Q. No.	Question	Marks		Question	Marks
Q.3	Briefly explain Human Computer Interaction (HCI)in terms of: a) Usability b) Common Problems c) Methods for Improvement d) Ethical and Social impacts e) Economic and Environmental Implications Provide relevant examples for each aspect.	1x5	OR	Explain the concept of: Minimum Viable Product (MVP) and its role in business validation with an example.	3+2
Q.4	A researcher is studying the effect of a new study technique on student performance. a) In the above context define Null Hypothesis and Alternative Hypothesis. b) Explain the role of P-values in hypothesis testing. c) Communicate your findings using data visuals.	2+2+1	***OR***	Why security methods are important for protecting data? Explain the role of the following methods in securing information and preventing identity theft. a) Two-factor authentication (2FA) b) Biometric verification c) Cryptography	2+3
Q.5	Emerging technologies are shaping the future of Pakistan's digital landscape. a) Why IoT is important for smart cities or smart agriculture in Pakistan? (Three points) b) Give two (02) suggestions that how a Blockchain-based system could improve security in Pakistan.	3+2	***OR***	Students are conducting research on the benefits of artificial intelligence in education. a) Explain two methods they can use to evaluate the credibility of online sources. b) Give significance of two (02) digital platforms they can use to present their findings in an interactive way. c) Why is it important to verify information before including it in research?	2+2+1
Q.6	Design a Vehicle Management System using Object-Oriented Programming (OOP) in Python. Requirements: a) Create a Vehicle class with attributes: type, brand, model, and mileage.	2+2+1		A company manages its organizational hierarchy using a tree/graph data structure as provided. The company wants to find a specific 	3+2

	b) Implement a constructor to initialize these attributes. Also add methods to update mileage and display details. c) Create two vehicle objects, update their mileage, and display their details.			employee (node) using an efficient search algorithm. a) Search the Security department using Depth-First Search (DFS) and Breadth-First Search (BFS). b) Outline the sequence of node visits in the selected search method.	

Federal Board HSSC-II Examination

Computer Science Model Question Paper

(Curriculum 2022-23)

Alignment of Questions with Student Learning Outcomes

Sr No	Section	Q. No. (Part no.)	Content Domain / Area	Student Learning Outcomes	Cognitive Level	Allocated Marks
1	A	Q1(i)	A1	Students will explain the usability, security and accessibility of devices, the systems they are integrated with.	K	1
2	A	Q1(ii)	A3	Identify and explain tradeoffs between the usability and security of computing recommend cybersecurity measures by considering different factors such as efficiency, cost, privacy, and ethics	U	1
3	A	Q1(iii)	B2	Understand and apply complex algorithms on data structures such as trees and binary search	U	1
4	A	Q1(iv)	B2	Understand and apply complex algorithms on data structures such as trees and binary search	A	1
5	A	Q1(v)	C1	Students should be able to understand and evaluate applications of various programming paradigms	U	1
6	A	Q1(vi)	D3	Students will learn how to [form hypotheses and perform hypothesis testing	K	1
7	A	Q1(vii)	D1	Students will be able to analyses data and identify key model performance metrics of real-world machine learning models	A	1
8	A	Q1(viii)	E3	Students should be able to assess policies that can help protect different stakeholders' interests	U	1
9	A	Q1(ix)	E2	Students should be able to describe deep learning and its applications	U	1
10	A	Q1(x)	F2	Discuss security threats and mitigation such as 2FA, biometric verification, and secure techniques for transmitting data	K	1
11	A	Q1(xi)	G1	Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools.	K	1
12	A	Q1(xii)	G1	Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools.	U	1
13	A	Q1(xiii)	H1	Students will create and test a minimum viable product for their business	U	1

Sr No	Section	Q. No. (Part no.)	Content Domain / Area	Student Learning Outcomes	Cognitive Level	*OR*	Content Domain / Area	Student Learning Outcomes	Cognitive Level	Allocated Marks
1.	B	Q2(i).	A1	Students will explain the usability, security and accessibility of devices, the systems they are integrated with.	K	***OR***	D1	Students will be able to analyses data and identify key model performance metrics of real-world machine learning models	K	3
2.	B	Q2(ii).	B2	Understand and apply complex algorithms on data structures such as trees and binary search	U	***OR***	F1	Identify and apply safe practices when collaborating on digital or online platforms	U	3
3.	B	Q2(iii).	B2	Understand and apply complex algorithms on data structures such as trees and binary search	A	***OR***	A3	Identify and explain tradeoffs between the usability and security of computing recommend cybersecurity measures by considering different factors such as efficiency, cost, privacy, and ethics	A	3
4.	B	Q2(iv).	D3	Students will learn how to form hypotheses and perform hypothesis testing	K	***OR***	F1	Identify and apply safe practices when collaborating on digital or online platforms	K	3
5.	B	Q2(v).	A2	Explain human interaction with computer systems in terms of • Usability• Common problems• Methods for improvements• Ethical, social, economic, and environmental implications	U	***OR***	F2	Discuss security threats and mitigation such as 2FA, biometric verification, and secure techniques for transmitting data.	U	3
6.	B	Q2(vi).	C2	Students should be able to use more advanced programming constructs such as data structures (lists etc.), file handling (disk 10 to write to storage), and databases in Python.	A	***OR***	D2	Students will explain and create a data visualization using Structured Query Language (SOL), or Python, or R)	A	3
7.	B	Q2(vii).	A3	Identify and explain tradeoffs between the usability and security of computing recommend cybersecurity measures by considering different factors such as efficiency, cost, privacy, and ethics	K	***OR***	D1	Students will be able to analyses data and identify key model performance metrics of real-world machine learning models	K	3
8.	B	Q2(viii).	A1	Students will explain the usability, security and accessibility of devices, the systems they are integrated with.	U	***OR***	B1	Understand and apply complex algorithms on data structures such as trees and binary search	U	3
9.	B	Q2(ix).	B2	Understand and apply complex algorithms on data structures such as trees and binary search	A	***OR***	C2	Students should be able to use more advanced programming constructs such as data structures	A	3

								(lists etc.), file handling (disk 10 to write to storage), and databases in Python.		
10.	B	Q2(x).	B2	Understand and apply complex algorithms on data structures such as trees and binary search	U	***OR***	G1	Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools.	U	3
11.	B	Q2(xi).	F3	Collaborate on strategies to provide equity and equal access to information	U	***OR***	G1	Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools.	U	3
12.	B	Q2(xii).	G1	Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools.	U	***OR***	E4	Students should be able to evaluate scenarios with data sharing and privacy conflicts and suggest policy decisions that can help achieve acceptable compromises	U	3
13.	B	Q2(xiii).	E2	Students should be able to describe deep learning and its applications	K	***OR***	D2	Students will explain and create a data visualization using Structured Query Language (SOL), or Python, or R)	K	3
14.	B	Q2(xiv).	E1	Students should be able to design ideas of applications relevant to Pakistan using 10T, Cloud computing, and Blockchain	U	***OR***	A2	Explain human interaction with computer systems in terms of:• Usability• Common problems• Methods for improvements• Ethical, social, economic, and environmental implications	U	3
1	C	Q3	A2	Explain human interaction with computer systems in terms of • Usability• Common problems• Methods for improvements• Ethical, social, economic, and environmental implications	K	***OR***	H1	Students will create and test a minimum viable product for their business	K	5
2	C	Q4	D3	Students will learn how to form hypotheses and perform hypothesis testing	U	***OR***	F2	Discuss security threats and mitigation such as 2FA, biometric verification, and secure techniques for transmitting data	U	5
3	C	Q5	E1	Students should be able to design ideas of applications relevant to Pakistan using 10T, Cloud computing, and Blockchain	U	***OR***	G1	Students will create an artifact that answers a research question, communicates results and conclusions through digital resources or tools.	U	5
4	C	Q6	C1	Students should be able to understand and evaluate applications of various programming paradigms	A	***OR***	B2	Understand and apply complex algorithms on data structures such as trees and binary search	A	5

*Cognitive Level	K: Knowledge	U: Understanding	A: Application

Table of Specification

Model Paper Computer Science – Grade XII (HSSC-II)

Cognitive Level	Domain A: Computer Systems	Domain B: Computational Thinking & Algorithms	Domain C: Programming Fundamentals	Domain D: Data and Analysis	Domain E: Applications of Computer Science	Domain F: Impacts of Computing	Domain G: Digital Literacy	Domain H: Entrepreneurship	Total Marks	Percentage (%)
Knowledge (K)	Q1-i (1)	-	-	Q1-vi (1)		Q1-x (1)	Q1-xi (1)	-	38	**27.74%**
	Q2 (i / f) 3 Q2 (vii / f) 3			Q2 (iv / f) 3 Q2 (i / s) 3 Q2 (xiii / s) 3 Q2 (vii / s) 3	Q2 (xiii / f) 3	Q2 (iv / s) 3				
	Q3-f (5)			-	-	-	-	Q3-s (5)		
Understanding (U)	Q1-ii (1)	Q1-iii (1)	Q1-v (1)	-	Q1-viii (1) Q1-ix (1)	-	Q1-xii (1)	Q1-xiii (1)	69	**50.36%**
	Q2 (v / f) 3 Q2 (viii / f) 3 Q2 (xiv / s) 3	Q2 (ii / f) 3 Q2 (x / f) 3 Q2 (viii / s) 3			Q2 (xiv / f) 3 Q2 (xii / s) 3	Q2 (xi / f) 3 Q2 (ii / s) 3 Q2 (v / s) 3	Q2 (xii / f) 3 Q2 (x / s) 3 Q2 (xi / s) 3			
	-	-	-	Q4-f (5)	Q5-f (5)	Q4-s (5)	Q5-s (5)	-		
Application (A)		Q1-iv (1)	-	Q1-vii (1)	-	-	-	-	30	**21.9%**
	Q2 (iii / s) 3	Q2 (iii / f) 3 Q2 (ix / f) 3	Q2 (vi / f) 3 Q2 (ix / s) 3	Q2 (vi / s) 3						
		Q6-s (5)	Q6-f (5)	-	-	-	-			
Total Marks	25	22	12	22	16	18	16	6	**137**	**100%**
%age	**18%**	**16%**	**9%**	**16%**	**12%**	**13%**	**12%**	**4%**	**100%**	

Note:

1 This ToS does not reflect policy, but it is particular to this model question paper.

2 Proportionate / equitable representation of the content areas as per the defined ranges may be ensured.

3 The percentage of cognitive level is 30%, 50%, and 20% for knowledge, understanding, and application, respectively with **± 5%** variation.

4 While selecting alternative questions for Short Response Questions (SRQs) and Extended Response Questions (ERQs), it must be kept in mind that:

- Difficulty levels of both questions should also be same
- SLOs of both the alternative questions must be different

Key: Question Number (part/ first choice) marks example: **Q2 (i / f) 2**
Question Number (part/ second choice) marks example: **Q2 (i / s) 2**

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