

Course Name: Software Engineering

Number of Questions: 6

Learning Outcomes:

1. Understand software analysis, design and development techniques and tools.

- **Question 1 (Understanding):** Which of the following software development methodologies focuses on collaboration, customer feedback, and small, rapid releases?

- A. Waterfall
- B. Agile
- C. V-Model
- D. Spiral

- **Question 2 (Understanding):** In UML diagrams, which symbol represents a class?

- A. Rectangle
- B. Oval
- C. Diamond
- D. Arrow

2. Demonstrate conceptual and technical skills in the analysis, design and implementation of a software system.

- **Question 3 (Applying):** Given a software requirement to calculate the area of a rectangle, which of the following is the most appropriate method signature for implementing this functionality in Java?

- A. `public void calculateArea(int width, int height)`
- B. `public int calculateArea(int width, int height)`
- C. `public double calculateArea(double width, double height)`
- D. `public Area calculateArea(Rectangle rectangle)`

- **Question 4 (Analyzing):** Which of the following design patterns is most suitable for creating a single instance of a database connection object?

- A. Factory Method
- B. Singleton
- C. Prototype
- D. Builder

- **Question 5 (Evaluating):** Consider a software system with the following non-functional requirements: maintainability, scalability, and performance. Which of the following architectural patterns would be the most appropriate choice?

- A. Layered Architecture
- B. Microservices
- C. Monolithic
- D. Event-Driven

3. Create requirements using use case modeling concepts.

- **Question 6 (Creating):** Which of the following best represents the primary actor in a use case for an online shopping system?

- A. Customer
- B. Product
- C. Shopping Cart
- D. Payment Gateway

Course Name: Web Programming

Number of Questions: 9

Learning Outcomes:

1. Understand concepts, principles and methods in programming for web and Internet environment.

- **Question 1 (Understanding):** Which of the following protocols is used for transferring web pages over the Internet?

- A. FTP

- B. SMTP
- C. HTTP
- D. IMAP

- **Question 2 (Understanding):** Which of the following HTML tags is used to create a hyperlink?

- A. `<a>`
- B. `<link>`
- C. `<href>`
- D. `<url>`

2. Apply Server Side scripting Languages and Implement client-side interactivity.

- **Question 3 (Applying):** Which of the following JavaScript statements creates a new HTML paragraph element with the text "Hello, World!"?

- A. `var p = document.createElement("p").innerText("Hello, World!");`
- B. `var p = document.createElement("p").innerHTML("Hello, World!");`
- C. `var p = document.createElement("p"); p.innerText = "Hello, World!");`
- D. `var p = document.createElement("p"); p.innerHTML = "Hello, World!");`

- **Question 4 (Applying):** In a PHP script, how do you retrieve the value of a form input field named "username" sent via a POST request?

- A. `$_GET['username']`
- B. `$_POST['username']`
- C. `$_REQUEST['username']`
- D. `$_SESSION['username']`

3. Specify, build and manage form and content of information-rich web sites.

- **Question 5 (Analyzing):** Which of the following CSS properties is used to set the space between the characters of a text?

- A. `margin`
- B. `padding`

- C. `letter-spacing`
- D. `line-height`

- **Question 6 (Creating):** Given the following HTML structure, which CSS selector targets the first paragraph inside the `

` element with the class "container"?

```
...
<div class="container">
  <p>First paragraph</p>
  <p>Second paragraph</p>
</div>
...
```

- A. `div.container p:first-child`
- B. `div.container p:first-of-type`
- C. `div.container p:nth-child(1)`
- D. `div.container p:first-line`

4. Design, implement and evaluate client-server systems following specific protocol specifications, taking into account concurrency issues.

- **Question 7 (Analyzing):** Which of the following concurrency control techniques is best suited for a web application with a high read-to-write ratio?

- A. Pessimistic locking
- B. Optimistic locking
- C. Timestamp ordering
- D. Two-phase locking

- **Question 8 (Evaluating):** Consider a web application with a RESTful API. Which of the following HTTP response status codes is most appropriate for indicating that a requested resource has been successfully created?

- A. 200 OK
- B. 201 Created
- C. 204 No Content
- D. 400 Bad Request

- **Question 9 (Evaluating):** In the context of WebSocket communication between a client and a server, which of the following is the primary advantage of using WebSockets over traditional HTTP requests?

- A. Lower latency due to full-duplex communication
- B. Increased security through encryption
- C. Improved compatibility with older browsers
- D. Reduced resource consumption on the server

Course Name: Fundamentals of Database Systems

Number of Questions: 6

Learning Outcomes:

1. Understand the principles of database design.

- **Question 1 (Understanding):** Which of the following is a key principle of the relational database model?

- A. Hierarchical data organization
- B. Data stored in tables with rows and columns
- C. Data stored as objects and attributes
- D. Network data structure

- **Question 2 (Understanding):** In database normalization, what is the main purpose of the third normal form (3NF)?

- A. Remove redundant data
- B. Ensure that every non-key attribute is fully functionally dependent on the primary key

- C. Eliminate transitive dependencies
- D. Organize data into a hierarchical structure

2. Apply the database concepts to real-world database design.

- **Question 3 (Applying):** Which of the following SQL statements is used to create a table called "students" with columns "id", "name", and "age"?

- A. `CREATE TABLE students (id INT, name VARCHAR(255), age INT);`
- B. `INSERT INTO students (id, name, age) VALUES (INT, VARCHAR(255), INT);`
- C. `SELECT id, name, age FROM students;`
- D. `UPDATE students SET id=INT, name=VARCHAR(255), age=INT;`

- **Question 4 (Analyzing):** Which of the following SQL statements removes all records from the "students" table where the "age" is less than 18?

- A. `DELETE FROM students WHERE age < 18;`
- B. `DROP FROM students WHERE age < 18;`
- C. `TRUNCATE students WHERE age < 18;`
- D. `REMOVE FROM students WHERE age < 18;`

3. Design database systems for real-world scenarios.

- **Question 5 (Creating):** Which of the following SQL statements adds a new column "email" to the "students" table?

- A. `ALTER TABLE students ADD email VARCHAR(255);`
- B. `ALTER TABLE students ADD COLUMN email VARCHAR(255);`
- C. `UPDATE students SET email VARCHAR(255);`
- D. `INSERT INTO students (email) VALUES (VARCHAR(255));`

- **Question 6 (Creating):** Which of the following is the correct SQL statement to create a foreign key constraint on the "student_id" column in the "enrollments" table, referencing the "id" column in the "students" table?

- A. `ALTER TABLE enrollments ADD FOREIGN KEY (student_id) REFERENCES students(id);`

- B. `ALTER TABLE enrollments ADD CONSTRAINT FOREIGN KEY (student\_id) REFERENCES students(id);`
- C. `CREATE FOREIGN KEY enrollments(student\_id) REFERENCES students(id);`
- D. `CREATE CONSTRAINT enrollments FOREIGN KEY (student\_id) REFERENCES students(id);`

****Course Name: Advanced Database Systems****

****Number of questions: 6****

1. ***Understand*** - Which of the following is a main concept of the object-oriented model?

- A. Tuple
- B. Encapsulation
- C. Normalization
- D. SQL

2. ***Apply*** - Which of the following is a recovery method used in case of a database failure?

- A. Redo logs
- B. Encryption
- C. Normalization
- D. Indexing

3. ***Analyze*** - In the context of database recovery, what does the ARIES algorithm stand for?

- A. Automatic Recovery In Every Situation
- B. Algorithm for Recovery and Isolation Exploiting Semantics
- C. Atomic Recovery and Isolation Exploiting Semantics
- D. Advanced Recovery and Isolation Exploiting Syntax

4. ***Apply*** - Which of the following is a key aspect of designing a distributed database system?

- A. Data replication

- B. Object-oriented programming
- C. SQL queries
- D. Encryption

5. *Create* - When designing a distributed database in a heterogeneous environment, which of the following factors should be considered?

- A. Network latency
- B. Consistency of data models
- C. Platform independence
- D. All of the above

6. *Evaluate* - In the context of query processing strategies, which of the following techniques can improve performance?

- A. Indexing
- B. Denormalization
- C. Partitioning
- D. All of the above

Course Name: Computer Programming

Number of questions: 6

1. *Understand* - Which of the following is a principle of computer programming?

- A. Encapsulation
- B. Data normalization
- C. DRY principle
- D. ACID properties

2. *Understand* - Which programming concept allows for code reuse and modular design?

- A. Recursion
- B. Inheritance
- C. Polymorphism
- D. Concurrency

3. *Apply* - Given the following code snippet, what is the output?

```
....  
  
int a = 5;  
int b = 10;  
int c = a * b;  
...
```

- A. 15
- B. 50
- C. 150
- D. 500

4. *Analyze* - In the context of debugging, what is the purpose of a breakpoint?

- A. To indicate the start of a loop
- B. To pause the execution of a program
- C. To mark the end of a function
- D. To indicate an error in the code

5. *Apply* - Which of the following mathematical principles can be used to prove statements in computing science?

- A. Set theory
- B. Calculus
- C. Geometry
- D. Trigonometry

6. *Evaluate* - When solving problems in computing science, which of the following can be used to optimize the performance of an algorithm?

- A. Time complexity analysis
- B. Space complexity analysis
- C. Use of design patterns
- D. All of the above

****Course Name: Object-Oriented Programming****

****Number of questions: 6****

1. *Understand* - Which of the following is a basic object-oriented concept?

- A. Inheritance
- B. Normalization
- C. Recursion
- D. Concurrency

2. *Apply* - In object-oriented programming, what is the purpose of a constructor?

- A. To define a class
- B. To create an instance of a class
- C. To define a method
- D. To create an interface

3. *Analyze* - Given the following code snippet, which principle of object-oriented programming is demonstrated?

....

```
class Animal {  
    public void makeSound() {  
        System.out.println("The animal makes a sound");  
    }  
}
```

```

    }
}
class Dog extends Animal {
    public void makeSound() {
        System.out.println("The dog barks");
    }
}
...

```

- A. Encapsulation
- B. Inheritance
- C. Polymorphism
- D. Abstraction

4. *Apply* - Which of the following is an example of encapsulation in object-oriented programming?

- A. Using public and private access modifiers
- B. Defining a class hierarchy
- C. Implementing multiple interfaces
- D. Overriding a method

5. *Analyze* - Consider the following code snippet:

```

....

class MyClass {
    private int myVar;

    public int getMyVar() {
        return myVar;
    }

    public void setMyVar(int myVar) {

```

```
        this.myVar = myVar;
    }
}
...
```

Which object-oriented programming principle is demonstrated in this code snippet?

- A. Inheritance
- B. Encapsulation
- C. Polymorphism
- D. Abstraction

6. *Evaluate* - In the context of object-oriented programming, which of the following can help improve the maintainability and reusability of code?

- A. Using design patterns
- B. Writing procedural code
- C. Minimizing the use of inheritance
- D. Avoiding encapsulation

Here are the multiple-choice questions for each of the three courses mentioned:

****Design and Analysis of Algorithms (6 questions)****

1. (Understand) Which of the following is NOT a technique for analyzing algorithm complexity?

- A. Time complexity
- B. Space complexity
- C. Amortized complexity
- D. Spectral complexity

2. (Analyze) Given two algorithms with time complexities $O(n^2)$ and $O(n \log n)$, which one is generally faster for large input sizes?

- A. $O(n^2)$

- B. $O(n \log n)$
- C. Both are equally fast
- D. Cannot be determined

3. (Apply) Which of the following techniques is best suited for solving the 0-1 knapsack problem?

- A. Greedy algorithm
- B. Divide and conquer
- C. Dynamic programming
- D. Backtracking

4. (Evaluate) Which of the following sorting algorithms has the best average-case performance?

- A. Bubble sort
- B. Selection sort
- C. Quick sort
- D. Merge sort

Data Structure and Algorithms (7 questions)

5. (Understand) Which of the following data structures uses the Last In First Out (LIFO) principle?

- A. Stack
- B. Queue
- C. Linked List
- D. Array

6. (Understand) What is the primary difference between a singly linked list and a doubly linked list?

- A. The number of nodes
- B. The type of elements stored
- C. The direction of traversal
- D. The memory allocation

7. (Analyze) Which of the following sorting algorithms is considered an in-place sorting algorithm?

- A. Merge sort
- B. Quick sort
- C. Heap sort
- D. Counting sort

8. (Apply) Which algorithm is most suitable for searching an element in a sorted array?

- A. Linear search
- B. Binary search
- C. Depth-first search
- D. Breadth-first search

9. (Analyze) Which of the following sorting algorithms has the worst-case performance of $O(n^2)$?

- A. Bubble sort
- B. Merge sort
- C. Quick sort
- D. Radix sort

10. (Evaluate) In which scenario would a hash table be the most efficient data structure?

- A. Finding the shortest path in a graph
- B. Storing and retrieving key-value pairs
- C. Sorting a list of integers
- D. Implementing a stack

****Data Communication and Computer Networking (6 questions)****

11. (Understand) Which layer of the OSI model is responsible for providing reliable end-to-end communication?

- A. Physical layer
- B. Data link layer
- C. Network layer
- D. Transport layer

12. (Understand) Which of the following protocols operates at the Application layer of the TCP/IP model?

- A. HTTP
- B. IP
- C. TCP
- D. UDP

13. (Understand) In the OSI model, which layer is responsible for routing packets between networks?

- A. Physical layer
- B. Data link layer
- C. Network layer
- D. Transport layer

14. (Apply) Given an IP address 192.168.1.0/24, which of the following is the broadcast address for this subnet?

- A. 192.168.1.255
- B. 192.168.1.0
- C. 192.168.0.255
- D. 192.168.0.0

15. (Analyze) How many usable IP addresses are there in a /26 subnet?

- A. 62
- B. 30
- C. 126

- D. 254

16. (Evaluate) Which of the following is NOT an advantage of using subnetting?

- A. Improved network security
- B. Easier network management
- C. Reduced network congestion
- D. Increased IP address range

****Computer Security****

1. (**Understand**) Which of the following is a basic concept in computer security?

- A. Cryptography
- B. File compression
- C. Data visualization
- D. Web design

2. (**Understand**) What is a common vulnerability in computer programs?

- A. Buffer overflow
- B. Typographical errors
- C. Insufficient storage
- D. Incompatible file formats

3. (**Analyze**) Which of the following is a basic requirement for a trusted operating system?

- A. Multitasking capabilities
- B. Mandatory access control
- C. Fast boot times
- D. User-friendly interface

4. (**Analyze**) In the context of database security, what does inference control aim to prevent?

- A. Unauthorized access to sensitive data
- B. Data corruption due to hardware failure
- C. Deriving sensitive information from non-sensitive data
- D. The use of outdated database management systems

5. (** Evaluate **) Which of the following techniques is most effective for ensuring the integrity of a multi-level database?

- A. Data masking
- B. Encryption
- C. Two-factor authentication
- D. View-based access control

****Network and System Administration****

1. (** Understand **) What is a primary role of a network administrator?

- A. Graphic design
- B. Content writing
- C. Ensuring network uptime
- D. Sales and marketing

2. (** Apply **) To provide network services to users, you must configure and maintain:

- A. Wi-Fi routers
- B. Email servers
- C. Firewalls
- D. All of the above

3. (** Analyze **) Which of the following is an example of a security policy?

- A. Password complexity requirements
- B. Office layout design

- C. Employee lunch break schedules
- D. Hardware procurement

4. (**Evaluate**) When troubleshooting, which of the following steps should be taken first?

- A. Replace all potentially faulty hardware
- B. Identify the problem
- C. Implement a solution
- D. Verify full system functionality

5. (**Evaluate**) In the context of system administration, which of the following is an essential skill?

- A. 3D modeling
- B. Video editing
- C. Scripting
- D. Public speaking

6. (**Create**) A system administrator wants to automate a task. What scripting language is commonly used for this purpose?

- A. Python
- B. Java
- C. PHP
- D. Swift

Introduction to Artificial Intelligence

1. (**Remember**) Which of the following is a component of artificial intelligence?

- A. Knowledge representation
- B. Website development
- C. Network topology
- D. Database normalization

2. (**Understand**) What is the role of heuristics in search problems and games?

- A. To provide shortcuts for finding solutions
- B. To store data efficiently
- C. To allow multiple users to play simultaneously
- D. To generate realistic graphics

3. (**Apply**) AI techniques can be used to gain insight into:

- A. Intelligence and perception
- B. Historical events
- C. Geographical locations
- D. Language translation

4. (**Understand**) What is the primary purpose of knowledge representation in artificial intelligence?

- A. To facilitate communication between AI agents
- B. To store data efficiently
- C. To model human-like reasoning and problem-solving
- D. To create realistic graphics

5. (**Analyze**) In which of the following situations would heuristic search be most advantageous?

- A. When the search space is relatively small
- B. When there is a well-defined solution
- C. When the optimal solution is not required
- D. When the problem can be solved through brute-force methods

6. (**Analyze**) Which of the following is a weakness of heuristic search techniques?

- A. They are computationally expensive
- B. They guarantee finding the optimal solution
- C. They can be prone to getting stuck in local optima

- D. They are difficult to implement

****Operating System****

1. Explain the objectives and functions of modern operating systems. (Understand)

Which of the following is an objective of modern operating systems?

- a) Providing a platform for software to execute
- b) Managing storage space
- c) Simplifying user interactions with the hardware
- d) All of the above

2. Describe the functions of a contemporary operating system with respect to convenience, efficiency, and the ability to evolve. (Understand)

Which of the following is a function of an operating system that ensures convenience for users?

- a) Memory management
- b) Multitasking
- c) User-friendly interface
- d) Security management

3. Describe the functions of a contemporary operating system with respect to convenience, efficiency, and the ability to evolve. (Apply)

An operating system has implemented a new feature that optimizes power consumption and extends battery life. Which aspect of the operating system is being addressed?

- a) Convenience

- b) Efficiency
- c) Evolvability
- d) Security

4. Explain conditions that lead to deadlock. (Analyze)

Which of the following conditions must hold simultaneously for a deadlock to occur?

- a) Mutual exclusion
- b) Hold and wait
- c) No preemption
- d) Circular wait
- e) All of the above

5. Compare and contrast the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems. (Analyze)

Which of the following scheduling algorithms is preemptive?

- a) First-Come, First-Served (FCFS)
- b) Shortest Job Next (SJN)
- c) Round Robin
- d) Priority Scheduling

6. Compare and contrast the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems. (Evaluate)

In a system that requires minimal response time with frequent context switches, which scheduling algorithm would be the most suitable?

- a) First-Come, First-Served (FCFS)
- b) Shortest Job Next (SJN)
- c) Round Robin
- d) Priority Scheduling

****Computer Organization and Architecture****

1. Identify different ways of communicating with I/O devices and standard I/O interfaces. (Understand)

Which of the following is a standard I/O interface for communication between a computer and peripheral devices?

- a) USB
- b) HDMI
- c) SATA
- d) All of the above

2. Identify different ways of communicating with I/O devices and standard I/O interfaces. (Analyze)

Considering the characteristics of a Direct Memory Access (DMA) controller and an Interrupt Request (IRQ) line, which method is more efficient for transferring large amounts of data?

- a) DMA
- b) IRQ

3. Describe different performance enhancement techniques in computer architecture. (Understand)

Which of the following is a performance enhancement technique in computer architecture?

- a) Pipelining
- b) Multiprocessing
- c) Caching
- d) All of the above

4. Describe different performance enhancement techniques in computer architecture. (Analyze)

Which performance enhancement technique allows multiple instructions to be executed simultaneously by dividing them into smaller stages?

- a) Pipelining
- b) Multiprocessing
- c) Caching
- d) Parallel processing

5. Explain the basic structure of computer hardware & software. (Understand)

Which of the following is an example of computer hardware?

- a) Operating system
- b) Central Processing Unit (CPU)
- c) Word processor
- d) Web browser

6. Identify the processes involved in the basic operations of CPU. (Analyze)

During the execution of an instruction, which of the following steps is performed by the CPU?

- a) Fetch

- b) Decode
- c) Execute
- d) All of the above

Automata and Complexity Theory

1. Which of the following is a formal grammar? (Understand)

- A. A set of rules for generating strings
- B. A set of strings
- C. A set of states and transitions
- D. A set of input alphabets

2. Which of the following language classes is a proper subset of another? (Understand)

- A. Context-free languages are a proper subset of regular languages
- B. Regular languages are a proper subset of context-free languages
- C. Context-sensitive languages are a proper subset of context-free languages
- D. Recursive languages are a proper subset of recursively enumerable languages

3. Given the following grammar, what type of formal language does it represent? (Understand)

...

$S \rightarrow aSb \mid \epsilon$

...

- A. Regular
- B. Context-free
- C. Context-sensitive

D. None of the above

****4. Which of the following is a valid recognizer for the language $L = \{a^n b^n \mid n \geq 1\}$? (Apply)****

A. Finite Automaton

B. Pushdown Automaton

C. Linear Bounded Automaton

D. Turing Machine

****5. For the given grammar, what is the production rule to eliminate left recursion? (Analyze)****

...

$A \rightarrow Ab \mid a$

...

A. $A \rightarrow aA'$

B. $A \rightarrow aB \mid bA'$

C. $A \rightarrow aA' \mid \epsilon$

D. $A \rightarrow aA' \mid bA'$

****6. In the context of complexity theory, which of the following is true? (Understand)****

A. $P \subseteq NP \subseteq PSPACE$

B. $P = NP = PSPACE$

C. $NP \subseteq P \subseteq PSPACE$

D. $PSPACE \subseteq NP \subseteq P$

Compiler Design

****1. Which of the following techniques is used for lexical analysis? (Apply)****

- A. Recursive descent parsing
- B. Regular expressions
- C. Bottom-up parsing
- D. Top-down parsing

****2. Which of the following is a characteristic of a context-free grammar? (Analyze)****

- A. Rightmost derivation
- B. Leftmost derivation
- C. Production rules with non-terminal symbols on the left side and terminal symbols on the right side
- D. Production rules with terminal symbols on the left side and non-terminal symbols on the right side

****3. What is the primary function of a scanner in a compiler? (Remember)****

- A. To generate intermediate code
- B. To recognize tokens in the input stream
- C. To check for syntax errors
- D. To optimize the code

****4. What is the main goal of syntax analysis in compiler design? (Understand)****

- A. To convert source code into an abstract syntax tree
- B. To evaluate the runtime efficiency of a program
- C. To perform semantic checks on the source code
- D. To optimize the generated code

****5. What is syntax-directed translation? (Understand)****

- A. A method of code generation based on the structure of the source code
- B. A method of code optimization based on the structure of the source code
- C. A method of error detection based on the structure of the source code
- D. A method of code obfuscation based on the structure of the source code

****6. Which of the following is a primary function of type checking in a compiler? (Understand)****

- A. To ensure that variables are initialized before use
- B. To detect and report type errors in a program
- C. To optimize the generated code
- D. To allocate memory for variables and data structures