NEC Registration Examination

Computer Engineering (ACtE)

Chapterwise Solved MCQ Practice Bank

50 Solved MCQs per Chapter (Chapters 1–10) — 500 Questions Total

EASY EXPLANATION



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Chapter 1: Concept of Basic Electrical and Electronics Engineering

1.1 Basic Concepts

1. Ohm's law V=IR holds true provided that:

a) Current is AC

b) Temperature remains constant

c) Resistance is zero

d) Voltage is negative

2. The SI unit of electrical conductance is:

a) Ohm

b) Farad

c) Siemens (mho)

d) Henry

3. For resistors in series, the equivalent resistance is:

a) Sum of reciprocals

b) Product over sum

c) Sum of all resistances

d) Average of resistances

4. For resistors in parallel, the same quantity across all resistors is:

a) Current

b) Voltage

c) Power

d) Resistance

5. Kirchhoff's Voltage Law is based on conservation of:

a) Charge

b) Energy

c) Mass

d) Momentum

6. Kirchhoff's Current Law is based on conservation of:

a) Energy

b) Charge

c) Momentum

d) Power

7. A resistor is an example of a:

a) Non-linear, unilateral element

b) Linear, bilateral element

c) Active element

d) Non-linear, bilateral, active element

8. An active element is one that:

a) Only dissipates energy

b) Can deliver energy/power gain

c) Cannot conduct current

d) Is always non-linear

9. In the Y-Δ (star-delta) conversion, the numerator for converting Δ to Y is:

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a) Sum of all delta resistances
b) Product of the two adjacent delta resistances
c) Sum of products of all resistor pairs
d) Difference of resistances

1.2 Network Theorems

10. Superposition theorem is applicable only to:
a) Non-linear circuits
b) Linear circuits
c) AC circuits only
d) DC circuits only

11. To deactivate a voltage source while applying superposition, it is replaced by a:
a) Open circuit
b) Short circuit
c) Resistor
d) Current source

12. Thevenin's equivalent circuit consists of:
a) A current source in parallel with resistance
b) A voltage source in series with resistance
c) Two resistors in series
d) A capacitor and inductor

13. Norton's resistance (RN) is related to Thevenin's resistance (Rth) by:
a) RN = 2Rth
b) RN = Rth
c) RN = Rth/2
d) RN = Rth^2

14. Maximum power transfer to a DC load occurs when:
a) RL = 0
b) RL = Rth
c) RL = infinity
d) RL = 2Rth

15. At series resonance, the circuit impedance is:
a) Maximum
b) Minimum, equal to R
c) Zero
d) Infinite

16. The resonant frequency of a series RLC circuit is given by:
a) $f0 = 2\pi\sqrt{(LC)}$
b) $f0 = 1/(2\pi\sqrt{(LC)})$
c) $f0 = LC/2\pi$
d) $f0 = 1/(LC)$

17. Apparent power S is related to active power P and power factor cosϕ by:
a) $S = P \times \cos\phi$
b) $P = S \times \cos\phi$
c) $S = P / \cos\phi^2$

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d) $P = S^2/\cos\phi$

1.3 AC Fundamentals

18. The RMS value of a pure sinusoidal wave with peak Em is:

a) 0.5 Em
b) 0.637 Em
c) 0.707 Em
d) Em

19. The average value of a sinusoidal wave over a half cycle is:

a) 0.707 Em
b) 0.637 Em
c) Em
d) 0.5 Em

20. The form factor of a pure sine wave is approximately:

a) 1.0
b) 1.11
c) 1.414
d) 2.0

21. The peak (crest) factor of a sine wave is approximately:

a) 0.707
b) 1.11
c) 1.414
d) 2.0

22. In a star-connected balanced 3-phase system, line voltage VL equals:

a) Vph
b) √3 × Vph
c) 3 × Vph
d) Vph/√3

23. In a delta-connected balanced 3-phase system, line current IL equals:

a) Iph
b) √3 × Iph
c) 3 × Iph
d) Iph/√3

24. The phase difference between adjacent phases in a balanced 3-phase supply is:

a) 60°
b) 90°
c) 120°
d) 180°

25. Angular frequency ω is related to frequency f by:

a) ω = f
b) ω = 2πf
c) ω = πf
d) ω = f/2π

1.4 Semiconductor Devices

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26. The typical cut-in voltage of a silicon diode is about:

a) 0.2 V
b) 0.3 V
c) 0.7 V
d) 1.5 V

27. The typical cut-in voltage of a germanium diode is about:

a) 0.3 V
b) 0.7 V
c) 1.0 V
d) 1.5 V

28. In a BJT, the current gain in Common Base configuration (α) is:

a) Always greater than 1
b) Always less than 1
c) Exactly 1
d) Negative

29. The relation between α and β of a BJT is:

a) $\beta = \alpha/(1-\alpha)$
b) $\beta = \alpha(1+\alpha)$
c) $\beta = 1-\alpha$
d) $\beta = \alpha-1$

30. Which BJT configuration is most commonly used for general amplification?

a) Common Base
b) Common Collector
c) Common Emitter
d) None of these

31. A MOSFET is fundamentally a:

a) Current-controlled device
b) Voltage-controlled device
c) Power-controlled device only
d) Frequency-controlled device

32. CMOS technology is preferred in digital ICs mainly due to:

a) High power consumption
b) Low static power dissipation
c) Large physical size
d) Slow switching speed

33. In reverse bias, a diode conducts only a small:

a) Forward current
b) Leakage current
c) Saturation voltage
d) Zener current always

1.5 Signal Generators (Oscillators)

34. An oscillator converts:

a) AC to DC
b) DC to AC

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c) AC to AC only
d) None of these

35. The Barkhausen criterion for sustained oscillation requires loop gain to be:
a) Less than 1
b) Exactly 1 with 0°/360° phase shift
c) Greater than 100
d) Negative

36. A Hartley oscillator uses which feedback element?
a) Tapped capacitor
b) Tapped inductor
c) Zener diode
d) Photodiode

37. A Colpitts oscillator uses which feedback element?
a) Tapped inductor
b) Tapped capacitor
c) Resistor divider
d) Transformer only

38. Which oscillator provides the highest frequency stability?
a) RC phase shift
b) Wien bridge
c) Crystal oscillator
d) Hartley

39. An RC phase-shift oscillator typically needs how many RC stages to get 180° shift?
a) 1
b) 2
c) 3
d) 5

40. Crystal oscillators rely on which property of quartz?
a) Photoelectric effect
b) Piezoelectric effect
c) Thermoelectric effect
d) Hall effect

1.6 Amplifiers

41. A Class A amplifier conducts for:
a) 180° of input cycle
b) 90° of input cycle
c) 360° (full cycle)
d) Less than 90°

42. Class B amplifiers typically have efficiency up to about:
a) 25%
b) 50%
c) 78.5%
d) 100%

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43. Crossover distortion is mainly associated with:

a) Class A amplifier

b) Class B push-pull amplifier

c) Class AB only

d) Op-amps

44. Class AB amplifiers are designed mainly to:

a) Increase distortion

b) Reduce crossover distortion of Class B

c) Eliminate the need for biasing

d) Reduce gain

45. A tuned amplifier uses which type of load to select a narrow frequency band?

a) Simple resistor

b) LC tank circuit

c) RC network

d) Diode bridge

46. For an ideal op-amp, the input impedance is:

a) Zero

b) Very low

c) Infinite

d) Equal to output impedance

47. For an ideal op-amp, the output impedance is:

a) Infinite

b) Very high

c) Zero

d) Equal to input impedance

48. The 'virtual short' concept in an op-amp with negative feedback means:

a) V+ and V− are physically connected

b) V+ equals V− with no current flowing into inputs

c) Output is shorted to ground

d) Input impedance is zero

49. Power BJTs primarily require additional consideration for:

a) Color coding

b) Heat dissipation (heat sinks)

c) Sound insulation

d) Light sensitivity

Additional Practice

50. A Wien Bridge oscillator is mainly used for generating:

a) High frequency RF signals

b) Low-distortion audio-frequency sine waves

c) Square waves only

d) DC voltages

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Chapter 2: Digital Logic and Microprocessor

2.1 Digital Logic

1. Which gates are known as Universal Gates?

a) AND, OR
b) NAND, NOR
c) XOR, XNOR
d) NOT only

2. According to De Morgan's theorem, (A+B)' equals:

a) A'+B'
b) A'·B'
c) A·B
d) A+B

3. According to De Morgan's theorem, (A·B)' equals:

a) A'·B'
b) A'+B'
c) A+B
d) A·B

4. In a K-map, adjacent cells differ by:

a) Two bits
b) Only one bit (Gray code)
c) All bits
d) Three bits

5. A group of 4 cells in a K-map eliminates how many variables?

a) 1
b) 2
c) 3
d) 4

6. XOR gate output is 1 when:

a) Both inputs are 0
b) Both inputs are 1
c) Inputs differ
d) Inputs are always equal

7. The 2's complement of a binary number is obtained by:

a) Inverting all bits
b) Inverting all bits and adding 1
c) Adding 1 only
d) Reversing bit order

8. SOP form is built using:

a) Maxterms
b) Minterms
c) K-map only
d) NOR gates only

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2.2 Combinational and Arithmetic Circuits

9. A 4:1 multiplexer requires how many select lines?

a) 1
b) 2
c) 3
d) 4

10. A decoder converts:

a) 2^n lines to n lines
b) n input lines to 2^n output lines
c) Analog to digital
d) Digital to analog

11. The SUM output of a half adder is:

a) A·B
b) A+B
c) $A \oplus B$
d) A'B'

12. The CARRY output of a half adder is:

a) $A \oplus B$
b) A·B
c) A+B
d) A'+B'

13. A full adder differs from half adder by having an additional:

a) Sum output
b) Carry-in input
c) Select line
d) Clock input

14. The Borrow output of a half subtractor (A−B) is 1 when:

a) A=1,B=0
b) A=0,B=1
c) A=B=1
d) A=B=0

15. Booth's algorithm is used for:

a) Unsigned addition
b) Signed multiplication
c) Division only
d) Decoding

16. An encoder converts:

a) n lines to 2^n lines
b) 2^n input lines to n output lines
c) Serial to parallel only
d) AC to DC

2.3 Sequential Logic Circuits

17. In an SR flip-flop, the invalid state occurs when:

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a) S=0,R=0
b) S=1,R=0
c) S=0,R=1
d) S=1,R=1

18. Which flip-flop has NO invalid/undefined state at all?
a) Basic SR flip-flop
b) JK flip-flop
c) Both have invalid states
d) D latch

19. In a JK flip-flop, J=K=1 causes the output to:
a) Hold
b) Reset
c) Set
d) Toggle

20. A T flip-flop can be made from a JK flip-flop by:
a) Grounding both J and K
b) Connecting J and K together as T
c) Removing the clock
d) Disconnecting Q

21. A Master-Slave flip-flop changes output on the:
a) Rising edge only
b) Falling edge of clock
c) Level of clock
d) Never

22. A latch differs from a flip-flop because a latch is:
a) Edge-triggered
b) Level-triggered
c) Never triggered
d) Always toggling

23. In an asynchronous (ripple) counter, flip-flops are clocked by:
a) A common clock
b) The output of the previous flip-flop
c) Random pulses
d) The reset line

24. A MOD-10 counter requires a minimum of how many flip-flops?
a) 2
b) 3
c) 4
d) 5

2.4 Microprocessor

25. Which unit performs arithmetic and logical operations in a microprocessor?
a) Control Unit
b) ALU
c) Program Counter

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d) Instruction Decoder

26. The Program Counter (PC) holds the address of:

a) The last executed instruction

b) The next instruction to fetch

c) The current data value

d) The stack top

27. The correct instruction cycle order is:

a) Decode-Fetch-Execute

b) Fetch-Execute-Decode

c) Fetch-Decode-Execute

d) Execute-Fetch-Decode

28. Assembly language is converted to machine code by a/an:

a) Compiler

b) Assembler

c) Interpreter

d) Linker only

29. The opcode in an instruction specifies:

a) The data value

b) The operation to perform

c) The memory address only

d) The register name only

30. Which register temporarily holds the instruction currently being executed?

a) PC

b) Instruction Register (IR)

c) Stack Pointer

d) MAR

2.5 Microprocessor System

31. In the memory hierarchy, moving from registers to secondary storage, capacity:

a) Decreases

b) Increases

c) Stays constant

d) Becomes zero

32. In memory-mapped I/O, devices are accessed using:

a) Special IN/OUT instructions

b) The same instructions as memory access

c) Interrupts only

d) DMA only

33. Asynchronous serial transmission uses which framing bits?

a) Parity bits only

b) Start and stop bits

c) Sync bits only

d) Clock bits

34. The main advantage of DMA is:

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a) Increases CPU workload
b) Transfers data without continuous CPU involvement
c) Removes need for memory
d) Slows down I/O

35. The 8255 is an example of a:
a) Serial-only interface
b) Programmable Peripheral Interface (parallel I/O)
c) Memory chip
d) Clock generator only

36. Cache memory is typically implemented using:
a) DRAM
b) SRAM
c) ROM
d) Magnetic tape

2.6 Interrupt Operations

37. When an interrupt occurs, the CPU first saves the:
a) Data registers only
b) Program Counter and flags
c) ALU output
d) I/O buffer

38. An interrupt that cannot be disabled by software is called:
a) Maskable
b) Non-maskable (NMI)
c) Software interrupt
d) Vectored interrupt

39. Compared to interrupts, polling is generally:
a) More efficient
b) Less efficient (wastes CPU time)
c) Identical in efficiency
d) Not usable in microprocessors

40. The instruction used to return from an ISR is:
a) RET
b) RETI
c) JMP
d) CALL

41. When multiple interrupts occur together, the CPU services them by:
a) Random order
b) Priority
c) Alphabetical order
d) Time of day

Additional Practice

42. A NAND gate with both inputs tied together behaves as a:
a) OR gate

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b) NOT gate
c) AND gate
d) XOR gate

43. The number of flip-flops required for a MOD-16 counter is:
a) 2
b) 3
c) 4
d) 5

44. A shift register that shifts data in serially and out serially is called:
a) SIPO
b) SISO
c) PISO
d) PIPO

45. In a synchronous counter, all flip-flops are triggered by:
a) Different clocks
b) The same common clock simultaneously
c) The previous flip-flop's output
d) No clock at all

46. The primary function of an instruction decoder is to:
a) Store data
b) Interpret the opcode and signal the control unit
c) Perform arithmetic
d) Generate the clock signal

47. A tri-state buffer has how many possible output states?
a) 1
b) 2
c) 3 (0, 1, high-impedance)
d) 4

48. The DMA controller requests bus control from the CPU via:
a) An interrupt only
b) Bus request/bus grant handshake
c) Direct memory write
d) Polling

49. Vectored interrupts automatically jump to:
a) A random address
b) A fixed, predefined ISR address
c) The reset vector always
d) The last executed instruction

50. A 3-to-8 decoder typically has how many outputs active at a time?
a) 1
b) 2
c) 3
d) 8

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Chapter 3: Programming Language and Its Applications

3.1 Introduction to C Programming

1. int a=5; int b=a++ + ++a; What is the value of b?

a) 10
b) 11
c) 12
d) 13

2. Which loop is guaranteed to execute at least once?

a) for
b) while
c) do-while
d) None of these

3. A recursive function must have a:

a) Loop
b) Base case
c) Global variable
d) Pointer

4. In C, 2-D arrays are stored in:

a) Column-major order
b) Row-major order
c) Random order
d) Reverse order

5. Which character terminates a C string?

a) '\n'
b) '\0'
c) EOF
d) Space

6. The 'break' statement in a loop causes:

a) Skipping to next iteration
b) Immediate exit from the loop
c) Program termination
d) Infinite loop

7. The 'continue' statement causes:

a) Exit from the loop
b) Skip to the next iteration
c) Program to pause
d) Function to return

8. Which operator has the highest precedence in C?

a) +
b) *
c) ()
d) =

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3.2 Pointers, Structure and Data Files in C

9. If pointer p (int*) holds address 2000, p+1 points to (int=4 bytes):

a) 2001
b) 2002
c) 2004
d) 2000

10. In a union, the memory allocated equals the size of the:

a) First member
b) Sum of all members
c) Largest member
d) Smallest member

11. Which function moves the file pointer for random access?

a) fopen()
b) fseek()
c) fprintf()
d) fclose()

12. An array name in C behaves as:

a) A variable
b) A constant pointer to its first element
c) A structure
d) A function

13. Passing a structure to a function BY POINTER mainly:

a) Always copies the whole structure
b) Avoids copying and allows modification
c) Is not allowed in C
d) Only works with unions

14. The file mode used to APPEND data to an existing file is:

a) "r"
b) "w"
c) "a"
d) "x"

15. struct vs union: struct members occupy:

a) The same memory location
b) Separate memory locations
c) No memory
d) Only 1 byte total

16. Sequential file access reads records:

a) In random order
b) In the order they are stored
c) Only backwards
d) Only the last record

3.3 C++ Language Constructs — Objects & Classes

17. Function overloading is resolved at:

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a) Runtime

b) Compile time (static binding)

c) Link time only

d) Never resolved

18. An inline function is used mainly to:

a) Increase code size only

b) Avoid function call overhead for small functions

c) Enable dynamic binding

d) Replace constructors

19. A destructor in C++:

a) Can be overloaded

b) Takes arguments

c) Has no return type and cannot be overloaded

d) Must be called manually

20. A static data member of a class is:

a) Created separately for every object

b) Shared by all objects of the class

c) Destroyed with each object

d) Only usable in main()

21. A friend function can access:

a) Only public members

b) Private and protected members too

c) No members at all

d) Only static members

22. The 'this' pointer inside a member function points to:

a) The base class

b) The calling object itself

c) A static member

d) The next object

23. Default arguments in C++ are used when:

a) The caller must always supply all arguments

b) The caller may omit some arguments, using default values

c) Functions cannot have parameters

d) Only in constructors

3.4 Features of Object-Oriented Programming

24. Which operator CANNOT be overloaded in C++?

a) +

b) ==

c) sizeof

d) []

25. In multiple inheritance, a derived class inherits from:

a) Exactly one base class

b) Two or more base classes

c) No base class

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d) Only itself

26. Destructor call order when a derived object is destroyed is:

a) Base then Derived

b) Derived then Base

c) Both simultaneously

d) Random

27. Converting a class object to a basic type uses a:

a) Copy constructor

b) Conversion operator

c) Friend class

d) Destructor

28. In hierarchical inheritance:

a) One base class has multiple derived classes

b) Multiple base classes have one derived class

c) Only single inheritance is allowed

d) Inheritance is impossible

29. Constructor call order in inheritance is:

a) Derived then Base

b) Base then Derived

c) Random order

d) Only Base is called

30. Operator overloading allows operators to:

a) Work only with built-in types

b) Work with user-defined types too

c) Be renamed entirely

d) Be removed from a class

3.5 Pure Virtual Function and File Handling

31. A class with at least one pure virtual function is called a/an:

a) Concrete class

b) Abstract class

c) Friend class

d) Static class

32. Runtime polymorphism in C++ is achieved using:

a) Function overloading

b) Operator overloading

c) Virtual functions

d) Default arguments

33. Which header provides manipulators like setw() and setprecision()?

a) <iostream>

b) <iomanip>

c) <fstream>

d) <string>

34. Which stream class is used to read from files?

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a) ofstream
b) ifstream
c) sstream
d) cout

35. The mechanism for selecting the correct virtual function at runtime uses a:
a) Symbol table
b) Vtable (virtual table)
c) Hash table
d) Stack frame

36. A pure virtual function is declared as:
a) virtual void f();
b) virtual void f() = 0;
c) void f() = virtual;
d) static void f();

3.6 Generic Programming and Exception Handling

37. A function template allows:
a) Only integers to be used
b) The same logic to work for multiple data types
c) No parameters at all
d) Only string data

38. Which is NOT a core STL component?
a) Containers
b) Algorithms
c) Iterators
d) Compilers

39. In exception handling, which block signals an error?
a) catch
b) try
c) throw
d) finally

40. catch(...) is used to:
a) Catch only integer exceptions
b) Catch any type of exception
c) Prevent exceptions from being thrown
d) Replace try block

41. If an exception has no matching catch block, the program calls:
a) main() again
b) terminate()
c) throw() automatically
d) Nothing happens

42. A class template is declared using the keyword:
a) class
b) template
c) generic

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d) typedef

43. Rethrowing an exception inside a catch block is done using:

a) throw;
b) catch;
c) rethrow;
d) retry;

Additional Practice

44. The scope resolution operator in C++ is:

a) ::
b) ->
c) .
d) :

45. Which C++ feature allows a class to have multiple constructors?

a) Constructor overloading
b) Destructor overloading
c) Operator hiding
d) Function inlining

46. In C, the format specifier for a float is:

a) %d
b) %f
c) %c
d) %s

47. A copy constructor is invoked when:

a) A new class is declared
b) An object is initialized from another object of the same class
c) A destructor runs
d) A function returns void

48. The keyword used to prevent a variable from being modified in C/C++ is:

a) static
b) const
c) volatile
d) extern

49. Dynamic memory allocation in C++ uses the operator:

a) malloc
b) new
c) alloc
d) create

50. The header file required for standard file I/O in C is:

a) stdlib.h
b) stdio.h
c) string.h
d) math.h

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Chapter 4: Computer Organization and Embedded System

4.1 Control and Central Processing Units

1. A microprogrammed control unit generates signals from information stored in:

a) Cache memory
b) Control memory (ROM)
c) The ALU
d) The accumulator

2. Which addressing mode gives the fastest operand access?

a) Indirect
b) Immediate
c) Indexed
d) Register indirect

3. RISC processors typically use which control unit design?

a) Microprogrammed
b) Hardwired
c) Software-based
d) None

4. Pipelining primarily improves:

a) Latency of a single instruction
b) Overall instruction throughput
c) Memory capacity
d) Power consumption alone

5. A hazard caused by an instruction needing a result not yet ready is called a:

a) Structural hazard
b) Data hazard
c) Control hazard
d) Address hazard

6. CISC processors typically use variable-length instructions and:

a) Fewer addressing modes
b) More addressing modes
c) No addressing modes
d) Only 1-cycle execution

7. Flynn's SIMD classification stands for:

a) Single Instruction Multiple Data
b) Single Instruction Multiple Devices
c) Serial Instruction Multiple Data
d) Simple Instruction Multiple Data

8. A control hazard in pipelining is typically caused by:

a) Memory access delay
b) Branch instructions changing flow
c) ALU overflow
d) Cache misses

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4.2 Computer Arithmetic and Memory System

9. Which memory type requires periodic refreshing?

a) SRAM
b) DRAM
c) ROM
d) EEPROM

10. Booth's algorithm is used for:

a) Unsigned addition
b) Signed multiplication
c) Division only
d) Address decoding

11. Which cache mapping allows any block to go in any line?

a) Direct mapping
b) Fully associative mapping
c) Set-associative mapping
d) Sequential mapping

12. LRU replacement policy replaces the block that:

a) Was used most recently
b) Has been unused the longest
c) Is the smallest
d) Was loaded first regardless of use

13. In write-through cache policy, main memory is updated:

a) Only when the line is replaced
b) Immediately, along with the cache
c) Never
d) Only at shutdown

14. SRAM is preferred for cache memory mainly because it is:

a) Cheaper than DRAM
b) Faster and needs no refresh
c) Non-volatile
d) Higher density

15. The principle that nearby memory locations are likely to be accessed soon is called:

a) Temporal locality
b) Spatial locality
c) Virtual locality
d) Cache locality only

4.3 Input-Output Organization and Multiprocessor

16. Which I/O mode wastes the most CPU time via continuous polling?

a) DMA
b) Interrupt-driven I/O
c) Programmed I/O
d) Memory-mapped I/O

17. In a tightly coupled multiprocessor system, processors typically:

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a) Have fully independent memory
b) Share common memory
c) Cannot communicate
d) Run one process forever

18. Which interconnection structure connects every processor to every memory module directly?
a) Bus-based
b) Crossbar switch
c) Ring topology
d) Star only

19. A semaphore is primarily used to achieve:
a) Faster arithmetic
b) Mutual exclusion/synchronization
c) Cache mapping
d) Instruction decoding

20. The main advantage of DMA over programmed I/O is:
a) Simpler hardware
b) Reduced CPU involvement in transfers
c) No memory needed
d) Slower transfer

21. Loosely coupled multiprocessor systems typically communicate via:
a) Shared memory only
b) Message passing over a network
c) Direct wires only
d) No communication

4.4 Embedded System Design

22. A system where missing a deadline causes catastrophic failure is called:
a) Soft real-time system
b) Hard real-time system
c) Stand-alone system
d) Networked system

23. The main disadvantage of a custom single-purpose (ASIC) processor is:
a) High power consumption
b) Lack of flexibility for future changes
c) Slow execution
d) Large size

24. An ASIP is best described as a processor with:
a) Fully general-purpose instructions
b) Instruction set customized for a specific domain
c) No instructions at all
d) Only hardwired logic

25. JTAG is primarily used in embedded systems for:
a) Compiling code
b) In-circuit hardware debugging
c) Memory storage

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d) Power management

26. The 'programmer's view' of an embedded processor refers to:

a) Physical chip layout

b) Registers, memory map and instruction set visible to software

c) Manufacturing process

d) Power supply design

27. Embedded systems are generally designed to perform:

a) General-purpose computing tasks

b) A specific, dedicated function

c) Only office applications

d) Only gaming tasks

4.5 Real-Time Operating and Control System

28. Threads of the same process typically:

a) Have completely separate memory

b) Share memory/resources of the process

c) Cannot run concurrently

d) Are always single per process

29. Which scheduling type is most associated with meeting deadlines in RTOS?

a) FCFS

b) SJF

c) Priority-based preemptive scheduling

d) Random scheduling

30. A mutex differs from a general semaphore because a mutex:

a) Allows unlimited access

b) Is a binary lock with ownership

c) Cannot be used for sync

d) Only works with interrupts

31. A closed-loop control system differs from open-loop by having:

a) No output

b) Feedback correcting output based on input

c) No input

d) Always lower cost

32. A device driver's main function is to:

a) Replace the OS

b) Provide a standard interface between OS and hardware

c) Perform arithmetic

d) Manage cache only

33. Round Robin scheduling uses a:

a) Fixed time quantum for each process

b) Single process running forever

c) No time limit

d) Only FCFS logic

4.6 Hardware Description Language and IC Technology

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34. In VHDL, which modeling style describes interconnected components (like a schematic)?

a) Behavioral

b) Structural

c) Dataflow only

d) None of these

35. A VHDL process for combinational logic should have in its sensitivity list:

a) Only the clock

b) All input signals used inside the process

c) No signals

d) Only outputs

36. 'rising_edge(clk)' in VHDL models:

a) Combinational logic

b) Sequential (edge-triggered) logic

c) Analog circuits

d) Power supplies

37. VHDL pipelining is typically implemented using:

a) No registers at all

b) Pipeline (clocked) registers between stages

c) External hardware only

d) Only combinational logic

38. VHDL is primarily used for:

a) Writing operating systems

b) Describing/simulating/synthesizing digital hardware

c) Web development

d) Database management

Additional Practice

39. The instruction pipeline stage that fetches the instruction from memory is:

a) ID

b) IF

c) EX

d) WB

40. Increasing cache size generally:

a) Increases the miss rate

b) Reduces the miss rate

c) Has no effect on miss rate

d) Always slows the CPU

41. Which memory type is non-volatile and electrically re-programmable multiple times?

a) DRAM

b) SRAM

c) EEPROM

d) Register file

42. A ROM that can be programmed once by the user (using a special device) is called:

a) PROM

b) DRAM

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c) SRAM
d) Cache

43. The number of address lines needed to address 1MB of memory is:

a) 10
b) 16
c) 20
d) 32

44. An I/O module's main role is to:

a) Perform arithmetic
b) Interface the CPU/bus with peripheral devices
c) Store the operating system
d) Generate clock pulses

45. A superscalar processor can execute:

a) Only one instruction per cycle
b) Multiple instructions per clock cycle
c) No instructions in parallel
d) Only floating-point instructions

46. The primary benefit of multithreading in embedded systems is:

a) Reduced code size
b) Improved responsiveness/concurrency
c) Lower clock speed requirement
d) Elimination of interrupts

47. In real-time systems, a hard deadline miss results in:

a) A minor quality reduction
b) Complete system failure
c) No consequence
d) Automatic retry

48. The datapath of a processor typically includes:

a) Only the control unit
b) Registers, ALU, and multiplexers
c) Only memory chips
d) Only the clock generator

49. An FPGA is best described as a:

a) Fixed-function ASIC
b) Reconfigurable hardware device
c) A type of RAM only
d) A software compiler

50. Interrupt latency refers to:

a) The clock speed of the CPU
b) Time between interrupt occurrence and start of ISR execution
c) The size of the interrupt vector table
d) The number of interrupts per second

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Chapter 5: Concept of Computer Network and Network Security System

5.1 Networks and Physical Layer

1. How many layers does the OSI model have?

a) 4
b) 5
c) 7
d) 8

2. The PDU at the Network layer is called a:

a) Frame
b) Packet
c) Segment
d) Bit

3. Which device forwards data based on MAC addresses?

a) Hub
b) Switch/Bridge
c) Router
d) Repeater

4. Which medium offers the highest bandwidth and EMI immunity?

a) Twisted pair
b) Coaxial cable
c) Fiber optic cable
d) Radio waves

5. TCP/IP's Internet layer corresponds to which OSI layer?

a) Transport
b) Network
c) Data Link
d) Application

6. A hub operates at which OSI layer?

a) Layer 1 (Physical)
b) Layer 2 (Data Link)
c) Layer 3 (Network)
d) Layer 4 (Transport)

7. The PDU at the Data Link layer is called a:

a) Packet
b) Frame
c) Segment
d) Bit

5.2 Data Link Layer

8. Which error technique can also CORRECT single-bit errors?

a) Parity check
b) Checksum

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c) Hamming code

d) CRC

9. In Stop-and-Wait flow control, the sender:

a) Sends multiple frames before waiting

b) Sends one frame and waits for ACK

c) Never waits

d) Uses no flow control

10. CSMA/CD is primarily used in:

a) Wireless LANs

b) Wired Ethernet (802.3)

c) Fiber point-to-point links

d) Satellite links

11. ARP resolves:

a) Domain name to IP

b) IP address to MAC address

c) MAC to IP

d) Port to process

12. IEEE 802.5 corresponds to which LAN technology?

a) Ethernet

b) Token Bus

c) Token Ring

d) Wireless LAN

13. CSMA/CA is mainly used in:

a) Wired Ethernet

b) Wireless LANs (802.11)

c) Fiber backbones

d) Satellite uplinks

14. Sliding window protocols compared to Stop-and-Wait give:

a) Lower throughput

b) Higher throughput

c) No change in throughput

d) No flow control at all

5.3 Network Layer

15. A Class B IP address's first octet range is:

a) 1–126

b) 128–191

c) 192–223

d) 224–239

16. If 3 bits are borrowed for subnetting, how many subnets result?

a) 3

b) 6

c) 8

d) 16

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17. OSPF is classified as which routing protocol type?

a) Distance Vector

b) Link State

c) Path Vector

d) Static routing

18. The size of an IPv6 address is:

a) 32 bits

b) 64 bits

c) 128 bits

d) 256 bits

19. BGP is primarily used for routing:

a) Within one LAN only

b) Between different autonomous systems

c) Inside one router

d) Only wireless networks

20. RIP uses which metric to determine best path?

a) Bandwidth

b) Hop count

c) Delay only

d) Cost in dollars

21. ICMP is primarily used for:

a) File transfer

b) Error reporting and diagnostics (e.g. ping)

c) Web browsing

d) Email delivery

5.4 Transport Layer

22. Which transport protocol is connection-oriented and reliable?

a) UDP

b) IP

c) TCP

d) ICMP

23. A socket is uniquely identified by:

a) MAC address + Port

b) IP address + Port number

c) Only port number

d) Only IP address

24. The well-known port number for HTTP is:

a) 21

b) 25

c) 80

d) 110

25. TCP connection termination uses a:

a) 2-way handshake

b) 3-way handshake

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c) 4-way handshake
d) No handshake

26. The TCP phase where congestion window grows exponentially is:
a) Congestion avoidance
b) Slow start
c) Fast recovery
d) Fast retransmit

27. UDP is generally preferred over TCP for:
a) File transfer requiring reliability
b) Real-time streaming/VoIP
c) Email
d) Banking transactions

5.5 Application Layer

28. HTTPS differs from HTTP mainly by adding:
a) Faster downloads
b) Encryption via SSL/TLS
c) A different image format
d) Support for images only

29. Which protocol resolves domain names to IP addresses?
a) FTP
b) DNS
c) SMTP
d) ARP

30. In a P2P network:
a) Only one central server exists
b) Each node can act as both client and server
c) No data sharing occurs
d) Clients cannot communicate directly

31. Wireshark is best described as a:
a) Network simulator
b) Packet capture and analysis tool
c) Routing protocol
d) Firewall

32. SNMP is primarily used for:
a) Sending emails
b) Monitoring/managing network devices
c) Transferring files
d) Resolving domain names

33. The default port for FTP control connection is:
a) 20
b) 21
c) 25
d) 80

EASY EXPLANATION

5.6 Network Security

34. Which is a core goal of the CIA security triad?

a) Complexity
b) Confidentiality
c) Compatibility
d) Cost-efficiency

35. An attack that only eavesdrops without modifying data is:

a) Active attack
b) Passive attack
c) DoS attack
d) Replay attack

36. RSA is an example of which cryptography type?

a) Symmetric-key
b) Asymmetric-key (public-key)
c) Hash-only
d) No key needed

37. A digital signature is created by encrypting the message hash with the sender's:

a) Public key
b) Private key
c) Session key
d) Symmetric key

38. A firewall's main function is to:

a) Speed up internet
b) Filter network traffic based on rules
c) Encrypt stored files
d) Replace antivirus

39. SSL/TLS is primarily used to secure:

a) Physical cables
b) TCP connections (e.g. HTTPS)
c) Power supplies
d) Printers

40. IPsec/VPN is used to create secure tunnels mainly at which layer?

a) Application layer
b) Network layer
c) Physical layer
d) Session layer

Additional Practice

41. The default subnet mask for a Class C network is:

a) 255.0.0.0
b) 255.255.0.0
c) 255.255.255.0
d) 255.255.255.255

42. A MAC address is how many bits long?

EASY EXPLANATION

a) 32 bits
b) 48 bits
c) 64 bits
d) 128 bits

43. Which layer is responsible for end-to-end error recovery and flow control?
a) Physical layer
b) Data Link layer
c) Transport layer
d) Application layer

44. A collision domain is broken up by using a:
a) Hub
b) Switch
c) Repeater
d) Coaxial cable

45. The maximum segment length for standard Cat5e Ethernet UTP cable is about:
a) 10 meters
b) 100 meters
c) 1000 meters
d) 10 kilometers

46. Telnet operates on which default port?
a) 21
b) 22
c) 23
d) 25

47. A VPN mainly provides:
a) Faster internet speed
b) A secure encrypted tunnel over a public network
c) Free public WiFi
d) Unlimited bandwidth

48. WEP wireless security is considered:
a) Very strong, still recommended
b) Weak/outdated, replaced by WPA/WPA2
c) Unbreakable
d) Not related to security

49. Which topology connects all devices to a single central hub/switch?
a) Bus topology
b) Ring topology
c) Star topology
d) Mesh topology only

50. The process of translating a private IP address to a public IP is called:
a) DNS
b) NAT (Network Address Translation)
c) ARP
d) DHCP only

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Chapter 6: Theory of Computation and Computer Graphics

6.1 Finite Automata

1. Every NFA can be converted to an equivalent DFA using:

a) Pumping lemma

b) Subset (powerset) construction

c) CYK algorithm

d) Kleene star

2. Which is NOT a valid regular expression operator?

a) Union (+)

b) Concatenation (.)

c) Kleene star (*)

d) Stack push

3. The Pumping Lemma for regular languages is used to:

a) Prove a language IS regular

b) Prove a language is NOT regular

c) Minimize a DFA

d) Convert NFA to DFA

4. In a DFA, for each state and symbol there must be:

a) Zero or more transitions

b) Exactly one transition

c) At least two transitions

d) An epsilon transition

5. Kleene's theorem establishes equivalence between:

a) CFG and PDA

b) Regular expressions and finite automata

c) Turing machines and PDA

d) CFG and Turing machines

6.2 Context-Free Languages

6. A grammar is ambiguous if:

a) It has no productions

b) Some string has more than one parse tree

c) It uses only terminals

d) It generates no strings

7. In CNF, a production must be of the form:

a) A→BCD

b) A→BC or A→a

c) A→aB only

d) A→ε always

8. A PDA differs from an FA by having an additional:

a) Extra tape

b) Stack

c) Multiple heads

EASY EXPLANATION

d) Random generator

9. CFGs are equivalent in power to:

a) Finite Automata

b) Pushdown Automata

c) Turing Machines

d) DFA only

10. BNF is commonly used to:

a) Optimize machine code

b) Define programming language syntax

c) Encrypt data

d) Design circuits

6.3 Turing Machines

11. A language is accepted by a TM when the machine:

a) Never halts

b) Halts in an accepting state

c) Runs out of tape

d) Reaches the start state again

12. A Non-Deterministic Turing Machine is:

a) More powerful than a DTM

b) Equal in power to a DTM

c) Less powerful than an FA

d) Unable to simulate anything

13. The Church-Turing Thesis states that:

a) All problems run in polynomial time

b) Any computable function can be computed by a TM

c) P equals NP

d) Every language is regular

14. A Universal Turing Machine can:

a) Solve only one problem

b) Simulate any other TM given its description

c) Run faster than all TMs

d) Avoid the halting problem

15. Reducibility is mainly used to prove:

a) Efficiency

b) Undecidability of a problem

c) Regularity

d) P=NP

6.4 Computer Graphics Overview

16. A raster scan display builds an image using:

a) A display list of lines only

b) A grid of pixels in a frame buffer

c) Vector equations only

d) No memory

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17. Vector (random) scan displays direct the beam:

a) Across every pixel

b) Only along lines to be drawn

c) Randomly

d) In a fixed circle

18. A display processor's main role is to:

a) Store files

b) Offload graphics computation from CPU

c) Manage networks

d) Cool the GPU

19. A light pen is classified as a/an:

a) Output device

b) Input device

c) Storage device

d) Network device

6.5 2D Transformation

20. x'=x+tx, y'=y+ty represents:

a) Rotation

b) Translation

c) Scaling

d) Shearing

21. Combining multiple 2D transformations into one matrix is called:

a) Clipping

b) Composite transformation

c) Windowing

d) Rasterization

22. In Cohen-Sutherland clipping, a line is trivially accepted when:

a) Both codes are non-zero

b) Both endpoint codes are 0000

c) AND of codes is non-zero

d) Only one endpoint is 0000

23. Compared to Cohen-Sutherland, Liang-Barsky is generally:

a) Less efficient

b) More efficient (parametric)

c) Unusable for lines

d) Only for 3D

24. The viewport refers to:

a) Region of world coordinates selected

b) Region of screen where content is displayed

c) A clipping algorithm

d) A transformation matrix type

6.6 3D Transformation

25. 3D rotation can occur about how many independent axes?

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a) 1
b) 2
c) 3
d) 4

26. In parallel (orthographic) projection, object size:
a) Shrinks with distance
b) Stays constant regardless of distance
c) Changes randomly
d) Only changes for red objects

27. Which projection is most used for realistic, photo-like rendering?
a) Orthographic
b) Oblique
c) Perspective
d) Isometric only

28. 3D composite transformations typically use matrices of size:
a) 2×2
b) 3×3
c) 4×4
d) 5×5

29. Oblique projection is a sub-type of:
a) Perspective projection
b) Parallel projection
c) Isometric projection only
d) None of these

Additional Practice

30. A DFA can have how many start states?
a) Exactly one
b) Exactly two
c) Any number
d) Zero

31. NFA stands for:
a) Non-deterministic Finite Automaton
b) New Finite Algorithm
c) Numeric Finite Array
d) None of these

32. The language accepted by a finite automaton is called a:
a) Context-free language
b) Regular language
c) Recursive language
d) Turing language

33. Regular languages are closed under which operation?
a) Union
b) No operations
c) Only subtraction

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d) None of these

34. The 'S' symbol in a CFG (V,T,P,S) represents the:

a) Set of terminals

b) Start symbol

c) Set of productions

d) Stack alphabet

35. A leftmost derivation replaces which non-terminal first at each step?

a) The rightmost one

b) The leftmost one

c) A random one

d) All at once

36. GNF stands for:

a) General Normal Form

b) Greibach Normal Form

c) Grammar Normal Function

d) Generic Node Form

37. A PDA accepts a string by reaching a final state or by:

a) Filling the stack completely

b) Reaching an empty stack

c) Running out of input only

d) Looping forever

38. A Turing Machine's tape is:

a) Finite in length

b) Infinite in length

c) Exactly 100 cells

d) Circular only

39. The 'blank' symbol on a TM tape represents:

a) The number zero

b) An empty/unwritten cell

c) The halt state

d) An error condition

40. Problems in class P are solvable in:

a) Exponential time

b) Polynomial time

c) Constant time always

d) Undecidable time

41. Problems in class NP have solutions verifiable in:

a) Exponential time

b) Polynomial time

c) No time at all

d) Infinite time

42. CRT stands for:

a) Cathode Ray Tube

b) Central Rendering Terminal

EASY EXPLANATION

c) Color Refresh Technology
d) Computer Raster Tool

43. A frame buffer stores:

a) Program instructions
b) Pixel intensity/color values for display
c) Network packets
d) File directory entries

44. Which of these is an OUTPUT device in a graphics system?

a) Light pen
b) Scanner
c) Plotter
d) Digitizer

45. The 2D rotation formula requires which trigonometric functions?

a) Only tangent
b) Sine and cosine
c) Only logarithm
d) Only exponential

46. Shearing a 2D shape along the x-axis changes the x-coordinate based on:

a) The y-coordinate value
b) A random factor
c) The z-coordinate
d) Nothing, shear doesn't change x

47. Homogeneous coordinates represent a 2D point (x,y) as:

a) (x,y)
b) (x,y,1)
c) (x,y,0)
d) (x,0,y)

48. In 3D graphics, Rz represents rotation about the:

a) x-axis
b) y-axis
c) z-axis
d) No specific axis

49. The Center of Projection (COP) is used in:

a) Orthographic projection
b) Perspective projection
c) Oblique projection only
d) No projection type

50. The 3D viewing pipeline ultimately maps coordinates to:

a) World coordinates
b) Screen/device coordinates
c) Object coordinates only
d) Viewing coordinates only

EASY EXPLANATION

Chapter 7: Data Structures & Algorithm, Database System and Operating System

7.1 Lists, Linked Lists & Trees

1. Big-O notation represents the:

a) Best case (lower bound)

b) Worst case (upper bound)

c) Average case only

d) Exact running time

2. The postfix form of A+B*C is:

a) AB+C*

b) ABC*+

c) A+BC*

d) *+ABC

3. Which linked list allows traversal in both directions?

a) Singly linked list

b) Doubly linked list

c) Circular singly linked list

d) None of these

4. In-order traversal of a BST produces elements in:

a) Random order

b) Sorted (ascending) order

c) Reverse sorted order

d) Level order

5. In an AVL tree, the balance factor of any node must be within:

a) -1, 0, +1

b) -2 to +2 only

c) 0 to +5

d) Unlimited

6. A Stack follows which principle?

a) FIFO

b) LIFO

c) Random access

d) Priority based

7. A Queue follows which principle?

a) LIFO

b) FIFO

c) Random access

d) Priority only

8. Static list structures use:

a) Dynamic memory/pointers

b) Contiguous fixed-size memory (arrays)

c) Only linked lists

d) No memory at all

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7.2 Sorting, Searching and Graphs

9. Which sort guarantees O(n log n) in the WORST case?

a) Quick Sort
b) Merge Sort
c) Insertion Sort
d) Bubble Sort

10. Binary search requires the array to be:

a) Sorted
b) Unsorted
c) A linked list
d) Circular

11. Which traversal uses a Queue data structure?

a) DFS
b) BFS
c) In-order
d) Post-order

12. Warshall's algorithm computes the:

a) Minimum spanning tree
b) Transitive closure of a graph
c) Shortest path only
d) Topological order

13. Dijkstra's algorithm fails correctly when the graph has:

a) Only positive weights
b) Negative edge weights
c) No cycles
d) One vertex only

14. Which sort has the WORST average performance among these?

a) Merge Sort
b) Quick Sort
c) Selection Sort
d) Heap Sort

15. Prim's algorithm is used to construct a:

a) Shortest path tree
b) Minimum Spanning Tree
c) Binary search tree
d) Hash table

16. Hashing gives average search time of:

a) O(n)
b) O(log n)
c) O(1)
d) $O(n^2)$

7.3 Data Models, Normalization and SQL

17. A relation is in 1NF if:

EASY EXPLANATION

a) It has a primary key
b) All attribute values are atomic
c) It has no foreign keys
d) It has fewer than 5 columns

18. A weak entity is characterized by:
a) Having its own unique primary key
b) Depending on a strong entity for identification
c) Never used in a database
d) Having no attributes

19. Removing partial dependency achieves which normal form?
a) 1NF
b) 2NF
c) 3NF
d) BCNF

20. In relational algebra, σ represents:
a) Projection
b) Selection
c) Join
d) Union

21. A database VIEW is best described as:
a) A physically stored duplicate table
b) A virtual table derived from a query
c) An index on a table
d) A type of primary key

22. Removing transitive dependency achieves which normal form?
a) 1NF
b) 2NF
c) 3NF
d) 0NF

7.4 Transactions, Concurrency and Recovery

23. Which ACID property ensures all-or-nothing execution?
a) Consistency
b) Atomicity
c) Isolation
d) Durability

24. In Two-Phase Locking, after releasing a lock, a transaction:
a) Can acquire new locks freely
b) Cannot acquire more locks (shrinking phase)
c) Must acquire all locks again
d) Is immediately aborted

25. Which is NOT one of Coffman's deadlock conditions?
a) Mutual exclusion
b) Hold and wait
c) Preemption allowed

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d) Circular wait

26. Write-Ahead Logging requires that:

a) Data written before log

b) Log written before database change

c) No logs needed

d) Only committed transactions logged

27. During recovery, REDO is used to:

a) Reverse uncommitted changes

b) Reapply committed transactions' changes

c) Delete all logs

d) Restart from scratch

7.5 Process Management & Synchronization

28. The PCB is used by the OS to store:

a) Only file data

b) All information needed to manage a process

c) Only login details

d) Source code

29. A binary semaphore is functionally similar to a:

a) Counting semaphore with unlimited value

b) Mutex (lock)

c) Round-robin scheduler

d) Page table

30. Which classical problem involves threads sharing a bounded buffer?

a) Dining Philosophers

b) Producer-Consumer

c) Readers-Writers

d) Banker's Algorithm

31. Round Robin scheduling uses:

a) No time limit

b) A fixed time quantum per process

c) Only priority

d) FCFS logic only

32. Priority scheduling can lead to:

a) Deadlock only

b) Starvation of low-priority processes

c) Thrashing

d) Fragmentation

7.6 Memory Management & File Systems

33. Belady's Anomaly is associated with which algorithm?

a) LRU

b) Optimal

c) FIFO

d) None of these

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34. Demand paging loads a page:

a) At process start, all at once

b) Only when actually referenced

c) Never

d) Only at shutdown

35. Which file allocation uses an index block listing all data blocks?

a) Contiguous

b) Linked

c) Indexed

d) Sequential

36. Thrashing occurs when:

a) System has excess free memory

b) System spends more time paging than executing

c) All processes are Ready

d) CPU is idle

37. Virtual memory gives each process the illusion of:

a) Unlimited CPU speed

b) A large, contiguous private address space

c) Direct access to others' memory

d) No page table needed

Additional Practice

38. A circular linked list's last node points to:

a) NULL

b) The first node

c) Itself always

d) The middle node

39. Time complexity to access an array element by index is:

a) O(n)

b) O(log n)

c) O(1)

d) $O(n^2)$

40. Merge sort follows which algorithm design paradigm?

a) Greedy

b) Divide and Conquer

c) Dynamic Programming

d) Backtracking

41. The worst-case time complexity of Quick Sort is:

a) O(n log n)

b) $O(n^2)$

c) O(log n)

d) O(n)

42. An adjacency matrix representation is more space-efficient for:

a) Sparse graphs

b) Dense graphs

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c) Trees only
d) Linked lists

43. A candidate key chosen as the primary identifier of a table is called the:
a) Foreign key
b) Primary key
c) Composite key
d) Super key only

44. The operation that combines rows from two tables based on a common column is:
a) Selection
b) Projection
c) Join
d) Union

45. A schedule is serializable if it is equivalent to some:
a) Parallel schedule
b) Serial schedule
c) Random schedule
d) Aborted schedule

46. Deadlock avoidance is commonly achieved using the:
a) Banker's algorithm
b) Round Robin algorithm
c) FCFS algorithm
d) LRU algorithm

47. Context switching refers to:
a) Deleting a process
b) Saving/restoring process state when switching the CPU between processes
c) Formatting memory
d) Compiling code

48. A zombie process is one that:
a) Is currently running
b) Has finished execution but still has an entry in the process table
c) Is waiting for I/O
d) Has unlimited priority

49. Internal fragmentation occurs mainly in which memory allocation scheme?
a) Fixed-size partitioning/paging
b) Variable partitioning only
c) Segmentation only
d) Linked allocation

50. The process of combining adjacent free memory blocks into one is called:
a) Paging
b) Compaction
c) Swapping
d) Thrashing

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Chapter 8: Software Engineering and Object-Oriented Analysis & Design

8.1 Software Process and Requirements

1. Which model pairs each dev phase with a corresponding test phase?

a) Waterfall
b) V-Model
c) Prototype
d) Big Bang

2. 'System shall respond within 2 seconds' is a:

a) Functional requirement
b) Non-functional requirement
c) User requirement only
d) Design constraint only

3. Agile model is characterized by:

a) Long rigid phases
b) Short iterations with continuous feedback
c) No testing
d) A single final delivery

4. The SRS document serves as a:

a) Source code repository
b) Contract between client and developer
c) Testing tool
d) PM software

5. Which requirements engineering stage confirms correctness with stakeholders?

a) Elicitation
b) Specification
c) Validation
d) Management

8.2 Software Design

6. Cohesion measures:

a) Coupling between modules
b) Relatedness of elements WITHIN a module
c) External dependencies
d) Code length

7. Low coupling between modules is desirable because it:

a) Increases dependency
b) Makes modules easier to modify independently
c) Slows the system
d) Removes need for testing

8. In layered architecture, which layer interacts directly with the database?

a) Presentation Layer
b) Business Logic Layer

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c) Data Access Layer
d) None

9. CBSE emphasizes:
a) Writing all code from scratch
b) Assembling systems from reusable components
c) Avoiding all reuse
d) Manual testing only

10. Real-time software design primarily prioritizes:
a) Maximum raw throughput
b) Meeting strict timing/deadline constraints
c) Minimizing code length
d) Avoiding interrupts

8.3 Testing, Cost Estimation & Quality

11. Which testing level is performed by the CLIENT to validate business needs?
a) Unit testing
b) Integration testing
c) System testing
d) Acceptance testing

12. COCOMO is used for:
a) Bug tracking
b) Software cost/effort estimation
c) Version control
d) UML diagramming

13. Brooks's Law states:
a) More people always finish faster
b) Adding manpower to a late project makes it later
c) Testing should be skipped
d) Requirements never change

14. CMMI Level 1 (Initial) is characterized by:
a) Fully optimized processes
b) Ad-hoc, chaotic, unpredictable processes
c) Quantitatively managed processes
d) Org-wide standardized processes

15. SCM is primarily concerned with:
a) Writing new features
b) Managing/controlling change to artifacts
c) UI design
d) Marketing

8.4 OO Fundamentals & Analysis

16. A Use Case primarily describes:
a) Internal code structure
b) An actor-system interaction to achieve a goal
c) Database schema

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d) Hardware layout

17. Which UML diagram shows the static structure of classes?

a) Sequence diagram
b) Class diagram
c) Activity diagram
d) Use case diagram

18. Multiplicity '1..*' means:

a) Exactly zero
b) Zero or one
c) One or many
d) Exactly one

19. A Sequence diagram shows:

a) Class inheritance only
b) Message flow between objects over time
c) Database tables
d) Hardware wiring

20. An Actor in a use case diagram represents:

a) A class attribute
b) Anything external interacting with the system
c) A database table
d) A design pattern

8.5 Object-Oriented Design

21. OO Design differs from OO Analysis because design:

a) Ignores the conceptual model
b) Adds implementation-specific detail to the model
c) Precedes requirements gathering
d) Never uses UML

22. A Collaboration diagram differs from Sequence diagram because it:

a) Shows different information entirely
b) Emphasizes object links rather than a timeline
c) Cannot show messages
d) Is for databases only

23. The '+' symbol in UML indicates:

a) Private visibility
b) Protected visibility
c) Public visibility
d) Static visibility

24. A design pattern is best described as:

a) Copied code
b) A reusable solution to a recurring design problem
c) A database schema
d) A testing framework

8.6 OO Implementation

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25. An attribute marked '–' in a class diagram becomes:

a) A public field

b) A private member variable

c) A separate class

d) A comment only

26. Messages in a sequence diagram typically become, in code, a:

a) New class definition

b) Method call between objects

c) Database table

d) Compiler directive

27. An association with multiplicity '1..*' is typically implemented as:

a) A single primitive variable

b) A collection/list of references

c) A boolean flag

d) A static constant

28. Separating normal logic from error handling in OO code uses:

a) Global variables

b) try/catch/throw

c) Inline comments only

d) Preprocessor macros

29. Inheritance (hollow triangle in UML) maps to which Java keyword?

a) implements

b) extends

c) inherits

d) uses

Additional Practice

30. Which model is best suited when requirements are unclear or unstable?

a) Waterfall Model

b) Prototype Model

c) Big Bang Model

d) V-Model

31. A stakeholder in a project is:

a) Only the project manager

b) Anyone with interest or influence on the project

c) Only the end user

d) Only the developer team

32. Requirements elicitation techniques include:

a) Interviews, surveys, and brainstorming

b) Only reading old code

c) Only guessing

d) Only compiling the program

33. The Waterfall model's main drawback is:

a) Too flexible for changes

b) Difficulty accommodating changes once a phase is complete

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c) No documentation produced
d) Too many iterations

34. High cohesion and low coupling together lead to:
a) Harder maintenance
b) Better maintainability and reusability
c) Slower execution always
d) More bugs

35. A reference architecture provides:
a) A random design
b) A proven template for a class of systems
c) Only database schemas
d) A testing checklist

36. Modular decomposition breaks a system into:
a) A single monolithic block
b) Smaller, manageable modules
c) Only two parts
d) Random pieces

37. Client-Server architecture separates:
a) Hardware from software
b) Service requesters (clients) from service providers (server)
c) Testing from development
d) Design from requirements

38. White-box testing is based on:
a) External functionality only
b) Internal code structure
c) User manuals only
d) Marketing requirements

39. Black-box testing is based on:
a) Internal code structure
b) External functionality, without knowing internal code
c) Compiler internals
d) Hardware design

40. A baseline in configuration management is:
a) An unreviewed draft
b) A formally reviewed and agreed-upon version of an artifact
c) A deleted file
d) A random backup

41. Regression testing is performed to:
a) Test only new features
b) Ensure new changes haven't broken existing functionality
c) Replace unit testing
d) Skip system testing

42. An 'extend' relationship in a use case diagram represents:
a) Mandatory reused behavior

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b) Optional additional behavior

c) A class attribute

d) A database key

43. An 'include' relationship in a use case diagram represents:

a) Optional behavior

b) Mandatory reused behavior

c) An error condition

d) A design pattern

44. A conceptual model is primarily built during which OO phase?

a) Implementation

b) Analysis

c) Testing

d) Deployment

45. A State diagram shows:

a) Class attributes only

b) The different states an object can be in and transitions between them

c) Database tables

d) Hardware wiring

46. An Activity diagram is most similar to a:

a) Class diagram

b) Flowchart

c) Sequence diagram

d) ER diagram

47. Determining which classes need to collaborate with each other is part of:

a) OO Design

b) Requirements gathering only

c) Deployment

d) Marketing

48. Encapsulation in OOP refers to:

a) Deleting unused code

b) Bundling data and methods while hiding internal details

c) Making all data public

d) Removing all classes

49. Polymorphism allows:

a) Only one class to exist

b) Objects of different classes to respond differently to the same method call

c) Variables to change type at runtime only

d) Functions to have no parameters

50. Abstraction in OOP focuses on:

a) Showing all implementation details

b) Exposing only essential features, hiding complexity

c) Removing all functions

d) Only used in databases

EASY EXPLANATION

Chapter 9: Artificial Intelligence and Neural Networks

9.1 AI Concepts and Intelligent Agents

1. PEAS stands for:

a) Process, Environment, Action, Sensor

b) Performance measure, Environment, Actuators, Sensors

c) Program, Engine, Agent, System

d) Perception, Efficiency, Automation, Speed

2. An agent that chooses actions based on an explicit goal is a:

a) Simple reflex agent

b) Model-based reflex agent

c) Goal-based agent

d) None of these

3. An environment where outcomes cannot be fully predicted is called:

a) Deterministic

b) Stochastic

c) Static

d) Observable

4. A Utility-Based agent differs from Goal-Based because it:

a) Has no goals

b) Selects the BEST action using a utility measure

c) Never considers the future

d) Only works single-agent

5. A Simple Reflex agent decides based on:

a) A model of history

b) Only the current percept

c) A long-term utility function

d) Communication with others

6. A fully observable environment means the agent's sensors give:

a) No information

b) Partial information

c) Complete state information

d) Random information

9.2 Search Techniques

7. Which uninformed search finds shortest path in unweighted graphs?

a) DFS

b) BFS

c) Depth-Limited Search

d) None of these

8. A* search evaluates nodes using:

a) f(n)=h(n) only

b) f(n)=g(n) only

c) f(n)=g(n)+h(n)

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d) f(n)=g(n)-h(n)

9. Hill Climbing can get stuck at a:

a) Global maximum only

b) Local maximum, plateau, or ridge

c) Random state

d) The goal prematurely

10. Simulated Annealing helps escape local maxima by:

a) Never accepting worse moves

b) Occasionally accepting worse moves, decreasing over time

c) Always choosing randomly

d) Stopping immediately

11. Alpha-Beta pruning compared to plain Minimax produces:

a) A different final decision

b) The SAME decision with less computation

c) A random decision

d) Only works for 1-player games

12. Iterative Deepening Search combines the benefits of:

a) BFS's completeness and DFS's low memory

b) Only DFS properties

c) Only BFS properties

d) A* and Greedy search

9.3 Knowledge Representation

13. In a semantic network, 'is-a' links represent:

a) Random facts

b) Hierarchical/inheritance relationships

c) Numerical data only

d) Database queries

14. A tautology in propositional logic is a formula that is:

a) Always false

b) True in some cases only

c) True under EVERY interpretation

d) Undefined

15. Unification in FOPL finds:

a) A conversion to English

b) A substitution making two expressions identical

c) A way to remove quantifiers

d) A semantic network

16. A Bayesian Network is structured as a:

a) Binary search tree

b) Directed Acyclic Graph (DAG)

c) Undirected cyclic graph

d) Linked list

17. Bayes' Rule allows computing:

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a) P(A) alone
b) P(A|B) from P(B|A) and priors
c) Only deterministic outcomes
d) Formula syntax

9.4 Expert Systems and NLP

18. In an expert system, rules are applied by the:
a) Knowledge Base
b) Inference Engine
c) User Interface
d) Explanation Facility

19. 'Knowing THAT a fact is true' describes:
a) Procedural knowledge
b) Declarative knowledge
c) Heuristic knowledge only
d) None of these

20. Determining sentence grammar structure is done in which NLP step?
a) Lexical analysis
b) Syntactic analysis (parsing)
c) Pragmatic analysis
d) Discourse integration

21. NLG refers to a machine's ability to:
a) Understand speech only
b) Produce human-readable language output
c) Recognize images
d) Perform arithmetic

22. In machine vision, identifying distinguishing characteristics is called:
a) Image Acquisition
b) Segmentation
c) Feature Extraction
d) Preprocessing

9.5 Machine Learning

23. A model trained on labeled data pairs uses:
a) Unsupervised learning
b) Supervised learning
c) Reinforcement learning
d) Fuzzy learning

24. ID3 selects splitting attributes based on:
a) Random selection
b) Information Gain/Entropy reduction
c) Alphabetical order
d) Fixed order

25. Naive Bayes assumes:
a) Features are perfectly correlated

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b) Features are conditionally independent given the class

c) Only one feature exists

d) No probability is zero

26. Converting fuzzy output back to crisp value is called:

a) Fuzzification

b) Rule evaluation

c) Defuzzification

d) Normalization

27. In Genetic Algorithms, combining genes from two parents is called:

a) Mutation

b) Selection

c) Crossover

d) Fitness evaluation

9.6 Neural Networks

28. The McCulloch-Pitts neuron produces:

a) Continuous real-valued output

b) Binary output based on a threshold

c) Only negative values

d) Random output

29. A single-layer Perceptron cannot solve:

a) AND

b) OR

c) XOR

d) NOT

30. Hebbian Learning is summarized as:

a) Survival of the fittest

b) Neurons that fire together, wire together

c) Garbage in, garbage out

d) Divide and conquer

31. Backpropagation trains a network by:

a) Randomly setting weights once

b) Propagating output error backward via gradient descent

c) Ignoring output error

d) Only adjusting input layer

32. A Hopfield Network is primarily used as:

a) A feedforward classifier only

b) Associative/content-addressable memory

c) A decision tree

d) A genetic algorithm

Additional Practice

33. Rationality in AI means an agent:

a) Always acts randomly

b) Acts to maximize its performance measure given its percepts

EASY EXPLANATION

c) Never uses sensors
d) Ignores its environment

34. A multi-agent environment involves:

a) Exactly one agent
b) More than one agent, possibly cooperating or competing
c) No agents at all
d) Only human agents

35. The Turing Test evaluates a machine's ability to:

a) Perform fast calculations
b) Exhibit human-like intelligent behavior indistinguishable from a human
c) Store large data
d) Connect to the internet

36. Constraint Satisfaction Problems are commonly solved using:

a) Backtracking search
b) Random guessing only
c) Only BFS
d) Only DFS

37. Bidirectional search works by:

a) Searching only forward from the start
b) Searching forward from start and backward from goal simultaneously
c) Searching only backward from goal
d) Not searching at all

38. A heuristic function that never overestimates the true cost is called:

a) Inadmissible
b) Admissible
c) Random
d) Negative

39. A frame in knowledge representation uses:

a) Nodes and edges only
b) Slots and fillers
c) Only numbers
d) Only pixels

40. Predicate logic extends propositional logic by adding:

a) More connectives only
b) Objects, predicates, and quantifiers
c) Only negation
d) Nothing new

41. The universal quantifier symbol is:

a) $\exists$
b) $\forall$
c) $\neg$
d) $\wedge$

42. Forward chaining in expert systems starts from:

a) A goal and works backward

EASY EXPLANATION

b) Known facts and derives conclusions

c) Random guesses

d) The user interface

43. Backward chaining starts from:

a) Known facts only

b) A goal, working backward to find supporting facts

c) The knowledge base structure

d) The explanation facility

44. A chatbot is a common application of:

a) Computer graphics

b) Natural Language Processing

c) Cryptography

d) Digital electronics

45. Clustering is an example of:

a) Supervised learning

b) Unsupervised learning

c) Reinforcement learning

d) None of these

46. Reinforcement learning agents learn via:

a) Labeled data pairs only

b) Rewards and penalties from the environment

c) Fixed rules only

d) Random guesses with no feedback

47. Overfitting occurs when a model:

a) Performs poorly on training data

b) Performs well on training data but poorly on new/unseen data

c) Never learns anything

d) Always underperforms

48. The learning rate in gradient descent controls:

a) The number of layers

b) The step size of weight updates

c) The activation function type

d) The number of neurons

49. A sigmoid activation function outputs values in the range:

a) (−1,1)

b) (0,1)

c) (0,∞)

d) (−∞,∞)

50. ReLU activation is defined as:

a) 1/(1+e^-x)

b) max(0,x)

c) tanh(x)

d) x^2

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Chapter 10: Project Planning, Design and Implementation

10.1 Engineering Drawings

1. In the ISO A-series, the LARGEST standard sheet size is:

a) A4
b) A3
c) A0
d) A2

2. A scale of 1:10 means the drawing is:

a) 10× larger than actual
b) 10× smaller than actual
c) Same size as actual
d) Not related to size

3. Isometric projection draws the 3 principal axes at:

a) 90° to each other
b) 45° to each other
c) 120° to each other
d) 180° to each other

4. A sectional drawing shows:

a) Only exterior color
b) Internal/hidden features via a cut-away view
c) Only the top view
d) Manufacturing cost

5. Orthographic projection is preferred when:

a) A quick 3D impression is needed
b) Precise manufacturing dimensions are required
c) Only a sketch is needed
d) Color is needed

10.2 Engineering Economics

6. A project should be accepted based on NPV when:

a) NPV < 0
b) NPV = 0 only
c) NPV > 0
d) NPV undefined

7. IRR is the discount rate at which:

a) NPV is maximized
b) NPV equals zero
c) Payback is shortest
d) Depreciation is highest

8. MARR stands for:

a) Maximum Allowed Return Rate
b) Minimum Acceptable Rate of Return
c) Marginal Annual Revenue Rate

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d) Monthly Adjusted Return Rate

9. Straight-line depreciation allocates cost:

a) Entirely in year 1

b) Equally each year over useful life

c) Randomly

d) Only in the last year

10. Discounted Payback Period differs from simple payback because it:

a) Ignores time value of money

b) Uses discounted (present value) cash flows

c) Ignores investment cost

d) Is always shorter

10.3 Project Planning and Scheduling

11. The Critical Path in a project network is the:

a) Shortest path

b) Longest path, determining minimum duration

c) Path with most resources

d) Path with zero cost

12. PERT differs from CPM mainly because PERT:

a) Uses one fixed time estimate

b) Uses 3 time estimates to model uncertainty

c) Cannot identify critical path

d) Is only for short projects

13. Activities on the critical path have slack/float of:

a) Maximum value

b) Zero

c) Negative infinity

d) One day

14. Resource Smoothing differs from Resource Leveling because it:

a) Always extends the end date

b) Balances resources without changing the end date

c) Ignores constraints

d) Needs unlimited resources

15. A Gantt chart is primarily used to show:

a) Cash flow only

b) A visual timeline of tasks

c) Risk probability

d) Org hierarchy

10.4 Project Management

16. Which risk strategy shifts risk to a third party (e.g. insurance)?

a) Avoid

b) Reduce

c) Transfer

d) Accept

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17. The correct tender process sequence is:

a) Award then Invite then Submit

b) Invite → Submit → Evaluate → Award

c) Submit then Award then Invite

d) Award then Invite then Submit

18. A contract with one fixed total price is called:

a) Unit Price contract

b) Cost-Plus contract

c) Lump Sum contract

d) Time and Materials

19. PPP is an example of:

a) A risk analysis technique

b) A project financing approach

c) A scheduling technique

d) A QC method

20. Assessing probability and impact of a risk is called:

a) Risk identification

b) Risk analysis

c) Risk transfer

d) Contract management

10.5 & 10.6 Professional Practice and NEC

21. The HIGHEST priority in engineering ethics is generally:

a) Maximizing profit

b) Public safety and welfare

c) Personal advancement

d) Minimizing duration

22. The body responsible for registering/licensing engineers in Nepal is:

a) Nepal Engineers' Association (NEA)

b) Nepal Engineering Council (NEC)

c) Ministry of Finance

d) Tribhuvan University

23. NEA primarily functions as a:

a) Government regulatory authority

b) Professional membership body for engineers

c) University accreditation board

d) A bank

24. OHS practices primarily aim to:

a) Increase project cost

b) Ensure a safe working environment

c) Speed up construction regardless of risk

d) Replace ethics

25. This NEC Registration Examination is conducted under the authority of:

a) Nepal Engineers' Association

b) Nepal Engineering Council

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c) Ministry of Education
d) Local municipality

Additional Practice

26. A bill of materials lists:
a) Project financing sources
b) Components/parts needed for a project
c) Employee salaries
d) Risk categories

27. The line used to show hidden edges in a drawing is:
a) A solid thick line
b) A dashed/hidden line
c) A center line
d) A dimension line

28. A center line in engineering drawing is represented as:
a) A solid line
b) A long-short dashed line
c) A thick solid line
d) A wavy line

29. First-angle projection is more commonly used in:
a) The United States only
b) Europe and Asia
c) Only in Australia
d) Nowhere, it's obsolete

30. Third-angle projection is the standard convention in:
a) Europe
b) The United States
c) Nepal only
d) None of these

31. Break-even analysis determines the point where:
a) Profit is maximized
b) Total revenue equals total cost
c) Depreciation is zero
d) IRR equals zero

32. A sunk cost is:
a) A future planned expense
b) A cost already incurred that cannot be recovered
c) Always tax-deductible
d) The same as salvage value

33. Inflation affects project economics by:
a) Increasing the purchasing power of money over time
b) Reducing the purchasing power of money over time
c) Having no effect at all
d) Only affecting foreign projects

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34. Salvage value refers to:

a) The initial purchase cost

b) The estimated value of an asset at the end of its useful life

c) The annual depreciation amount

d) The tax rate applied

35. Working capital refers to:

a) Long-term investment only

b) Funds needed for day-to-day operational expenses

c) Fixed asset value

d) Depreciation reserve

36. A milestone in project scheduling represents:

a) A long task with many resources

b) A significant event or checkpoint with zero duration

c) A type of contract

d) A budget overrun

37. Float/slack in a network diagram represents:

a) The critical path length

b) The amount of time an activity can be delayed without delaying the project

c) The total project cost

d) The number of resources needed

38. The Work Breakdown Structure (WBS) is used to:

a) Calculate NPV

b) Decompose the project into manageable tasks

c) Assign risk categories

d) Draft contracts

39. Crashing a project schedule means:

a) Cancelling the project

b) Adding resources to shorten activity durations, usually at extra cost

c) Removing all resources

d) Ignoring the critical path

40. Lag in scheduling refers to:

a) A delay inserted between dependent activities

b) The total project duration

c) A type of resource

d) A risk category

41. A feasibility study is conducted to:

a) Finalize the design

b) Assess whether a project is viable before committing resources

c) Sign the final contract

d) Close out the project

42. Stakeholder management involves:

a) Ignoring external parties

b) Identifying and managing the expectations of all interested parties

c) Only managing the budget

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d) Only managing the schedule

EASY EXPLANATION

43. A change request in project management must be:

a) Implemented immediately without review

b) Formally evaluated and approved before implementation

c) Always rejected

d) Ignored if minor

44. Project scope creep refers to:

a) Planned scope expansion with proper approval

b) Uncontrolled expansion of project scope without corresponding adjustments

c) A reduction in scope

d) A type of contract

45. A performance bond in a contract guarantees:

a) The client will pay on time

b) The contractor will fulfill contractual obligations

c) Unlimited project extensions

d) Free materials

46. Continuing Professional Development (CPD) for engineers ensures:

a) Engineers only earn more money

b) Engineers keep their skills and knowledge up to date

c) Engineers avoid registration

d) Engineers skip exams

47. An engineer discovering a safety violation should:

a) Ignore it to avoid conflict

b) Report it through proper channels, prioritizing public safety

c) Hide it from the client

d) Wait until project completion

48. The Nepal Engineering Council Act primarily governs:

a) Banking regulations

b) Registration and regulation of professional engineers in Nepal

c) University admissions

d) Tax collection

49. A conflict of interest in engineering practice occurs when:

a) An engineer follows the code of ethics

b) Personal interests could improperly influence professional judgment

c) An engineer signs a contract

d) An engineer attends training

50. Sustainable engineering design primarily aims to:

a) Maximize resource consumption

b) Minimize environmental impact while meeting present needs

c) Ignore future generations' needs

d) Increase waste production

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