



Object

971

281
Syllabus

Website: <https://duranta.app/>

BPSC Non Cadre CSE/ICT Departmental Question Solve

Subject-wise listing of all the MCQs

Programming / C++ / OOP

array, pointer
string, looping

Programming 971

Introduction to computer programming. Assembling language programming. Problem solving techniques, algorithm specification and development. Programming style, testing and debugging. Program design techniques: Structured and modular program design. Programming languages and paradigms: classification. Programming in C: Data type, statements, **control structures, arrays, pointers, strings, functions**, preprocessor directives, structures, unions and bit-fields, files. Introduction to object-oriented programming: **Encapsulation, inheritance and polymorphism**, Mechanic Language Programming, Template functions and classes multi-threads exceptions, **Class and object**. Introductory programming with C++/JAVA.

Programming Language 281

Structured programming language: data types, operators, expressions, control structures; Functions and program structure: parameter passing conventions, scope rules and storage classes, recursion; Header files; Preprocessor; Pointers and arrays; Strings; Multidimensional array; User defined data types: structures, unions, enumerations; Input and Output: standard input and output, formatted input and output, file access; Variable length argument list; Command line parameters; Error Handling; Graphics; Linking; Library functions. Object Oriented Programming language: Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Encapsulation, **classes and objects, access specifiers**, static and nonstatic members; **Constructors, destructors and copy constructors**; Array of objects, object pointers, and object references; **Inheritance**, single and multiple inheritance; Polymorphism: **overloading**, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O; Template functions and classes; Multithreaded Programming.

1: Which of the following do not return any value? [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

- ক) Constructor function ঘ) Friend function গ) Inline Function ঘ) Member Function

Answer: ক) Constructor function

Explanation: A constructor in C++ is a special function that initializes objects. It does not return any value, not even void.

(যখন একটি ক্লাসের অবজেক্ট ক্রিয়েট হয়, তখন কন্সট্রাক্টর অটো কল হয়)

```
#include <iostream>
using namespace std;
class A {
public:
    // Constructor of the class without
    // any parameters
```

Website: <https://duranta.app/>

```
A() {
    cout << "Constructor called" << endl;
}
};
int main() {
    A obj1;
    return 0;
}
```

Friend function: a friend function can be granted special **access to private and protected members** of a class in C++. They are not the member functions of the class but can access and manipulate the private and protected members of that class for they are declared as friends.

A friend function can be:

- ✓ A global function
- ✓ A member function of another class

Inline Function: The whole code of the inline function is inserted or substituted at the point of its call during the compilation instead of using the normal function call mechanism.

```
#include <iostream>
using namespace std;
// Inline function
inline int square(int x) {
    return x * x;
}
int main() {
    int num = 5;
    // Calling inline function
    int res = square(num);
    cout << res;
    return 0;
}
```

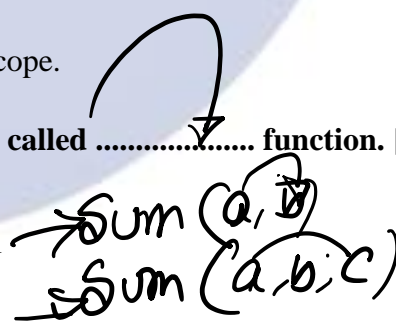
Member Function: a function that is declared in a class scope.

2: A function having more than one distinct meaning is called function. [সাধারণ

পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Parameter খ) Prototype গ) Overloaded ঘ) Polymorphism

Answer: গ) Overloaded



Explanation: A function is said to be overloaded when it has multiple definitions with the same name but different parameters. This is known as function overloading in C++.

Compile time polymorphism in which a function can perform different jobs based on the different parameters passed to it. It is a feature of object-oriented programming that increases the readability of the program.

```
int add (int a, int b) {  
    return a + b;  
}  
int add (int a, int b, int c) {  
    return a + b + c;  
}
```

access public, private protected

3: Which of the following modifiers cannot be applied to a method in C++? [সাধারণ পূলের

আওতায় সহকারী প্রোগ্রামার ২২]

ক) Protected ✓ খ) Private ✓ গ) Public ✓ ঘ) Abstract ✗

Answer: ঘ) Abstract

Explanation: In C++, abstract is not a modifier. Instead, an abstract class is defined by including at least one pure virtual function. The keywords private, protected, and public are valid method access modifiers.

Public:

Members declared as public are accessible from anywhere in the program, both inside and outside the class.

This is typically used for interfaces and functions that need to be exposed to external code.

Private:

Members declared as private are only accessible from within the same class.

They cannot be accessed directly from outside the class or by derived classes.

This promotes data hiding and encapsulation, ensuring that internal implementation details are not directly manipulated by external code.

By default, class members are private if no access modifier is specified.

Protected:

Members declared as protected are accessible within the same class and by derived classes (classes that inherit from the current class).

They are not accessible directly from outside the class by non-derived classes.

This allows for controlled access in inheritance hierarchies, where derived classes need to access base class members for specific functionalities.

4. Assuming an int is of 4 bytes, What is the size of “int array[15]”? [সাধারণ পূলের আওতায়

সহকারী প্রোগ্রামার ২২]

ক) 15 খ) 19 গ) 11 ঘ) 60 ✓

Answer: ঘ) 60

int = 4
15 × 4 = 60

Explanation: Each int takes 4 bytes. So, int array [15] will take $15 \times 4 = 60$ bytes.

5. In C++, The library function exit () causes an exit from—[সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) a block of statement খ) a loop in which it occurs গ) a function in which it occurs ঘ) a program in which it occurs

Answer: ঘ) a program in which it occurs

Explanation: The exit () function terminates the entire program immediately, regardless of where it is called.

6. When you pass an array as an argument to a function, what actually gets passed? [AME-Gen. Pull-2019]

- A. All the elements of the array
- B. The first element of the array
- C. Address of the first element of the array
- D. Address of the last element of the array

Answer: C

```
#include <stdio.h>
```

```
// Array passed as an array without the size of its
```

```
// dimension
```

```
void printArr(int arr[], int n) {
```

```
    for (int i = 0; i < n; i++)
```

```
        printf("%d ", arr[i]);
```

```
}
```

```
int main() {
```

```
    int arr[] = {1, 2, 3, 4, 5};
```

```
    // Pass array to function
```

```
    printArr(arr, 5);
```

```
    return 0;
```

```
}
```

Explanation: In C/C++, when you pass an array to a function, it decays into a pointer, meaning the address of the first element is passed to the function. This allows the function to access and modify the original array elements directly using pointer arithmetic.

7. A constructor is a special type of- [AME-Gen. Pull-2019]

- A. Class
- B. Field
- C. Method
- D. Property

Answer: C

Explanation: A constructor is a special kind of method in object-oriented languages like C++,

exit() output show

```
fn(arr, int a)
main() {
    fn(arr, 5);
}
```

Concepts
 State CS
 Examveda
 PSC 2
 indiabix
 sunfoundry
 geeksforgeeks.org
 tutorials point

function

Website: <https://duranta.app/>

Java, and C#. It has the same name as the class and is used to initialize objects. Constructors are automatically called when an object is created and do not have a return type.

8. What is the following declaration for? int (*a)[10]; [AME-Gen. Pull-2019]

- A. Pointer to an array of 10 integers
- B. Array of 0 function pointers returning integer
- C. A pointer to function returning an array of 10 integers
- D. Array of 10 integers pointers

Answer: A

Explanation: The parentheses around *a mean that a is a pointer, not an array. The expression int (*a)[10] tells the compiler that a is a pointer to an array of 10 integers. Without parentheses, it would be int *a[10], which is an array of 10 pointers to integers.

9. What is default inheritance in C++? [AME-Gen. Pull-2019]

- A. Public
- B. Private
- C. Protected
- D. Compile time error

Answer: B

Explanation: In C++, when you inherit a base class without specifying an access modifier, the inheritance is **private by default**. This means that public and protected members of the base class become private in the derived class unless explicitly declared otherwise.

```
class Base {
public:
    int x = 5;
};
class Derived : Base { // equivalent to `private Base`
public:
    void show() {
        // x is private here due to private inheritance
        // std::cout << x; // ✗ Error
    }
};
```

class → private inheritance by default
 struct → public inheritance by default

You can override the default by explicitly specifying public, protected, or private.

10. C programming invalid variable name? [DoICT ANE 2019]

- a. Average
- b. N# of students
- c. Xzy

$\frac{x}{y}$

return-type

$\frac{a-b}{ab}$



d. y23z

Answer: b. No#of-students

Explanation: In C, variable names cannot contain special characters like # or -. So, No#of-students is invalid. Valid variable names can include letters, digits, and underscores, but must not start with a digit or include symbols.

11. In C programming, which keyword is used to come out from a loop structure? [DoICT ANE 2019]

- a. break
- b. if
- c. switch
- d. continues

*for(; ;)
break;*

Answer: a. break

Explanation: The break statement is used to exit a loop (for, while, do-while) or a switch block immediately, bypassing any remaining iterations or cases. It is crucial for terminating loops based on conditions checked within the loop body.

```
#include <stdio.h>
```

```
int main() {  
    for (int i = 1; i <= 5; i++) {  
        if (i == 3) {  
            continue; // Skips the rest of the code for i = 3  
        }  
        printf("%d\n", i);  
    }  
    return 0;  
}
```

Output:

1
2
4
5

12. What is the output? [DoICT ANE 2019]

```
#include <stdio.h>  
int main() {  
    printf("%c", 100);  
    return 0;  
}
```

(%c)

*%d,
ASCII*

- a. 100
- b. one hundred
- c. d
- d. 0

Answer: c. d

Explanation: The ASCII code for 100 corresponds to the character 'd'. Using %c in printf() prints the character associated with that ASCII value, not the number itself.

ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	\$	68	44	D	100	64	d ✓
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[END OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

o/c, 100)

13. A computer program that converts an entire program into machine language is called a/an; [সাধারণ পুনের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Interpreter খ) Converter গ) Simulator ঘ) ~~Compiler~~

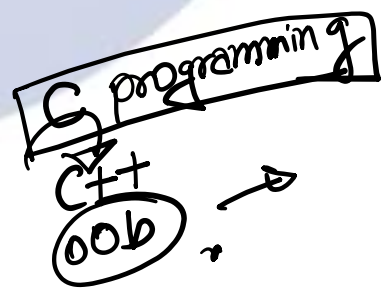
Answer: ঘ) Compiler

Explanation: A compiler translates an entire source program into machine code before execution.

Analysis

- ✓ Constructor Basic [2]
- ✓ Polymorphism basic-compile time polymorphism
- ✓ Access Modifiers
- ✓ Array Declaration
- ✓ Function &* Pointer Basic [2]
- ✓ Inheritance basic
- ✓ C Programming- variable declaration
- ✓ Looping structure and conditional statement
- ✓ Output problem and ASCII

Output



Digital Systems / Logic / Circuits

1. The logic gate that will have a low output when any one of its inputs is High is... [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) NAND gate খ) AND gate গ) NOR gate ঘ) OR gate

Answer: গ) NOR gate

Explanation: NOR gate outputs low when any input is high.

2. Which of the following numbers is the next sequence number of 77(8) in Octal? [সাধারণ পূলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) 88 খ) 80 গ) 100 ঘ) 99

Answer: গ) 100

Explanation: Octal $77 + 1 = 100$ in octal. (Octal 77 = Decimal 63. $63 + 1 = 64 = \text{Octal } 100$)

$$77_8 = 7 \times 8^1 + 7 \times 8^0$$

$$= 7 \times 8 + 7 \times 1$$

$$= 56 + 7 = 63_{10}$$

$$63 + 1 = 64_{10}$$

$$64 \div 8 = 8 \text{ remainder } 0$$

$$8 \div 8 = 1 \text{ remainder } 0$$

$$1 \div 8 = 0 \text{ remainder } 1$$

$$\text{So, } 64_{10} = 100_8$$

3. 10101111 OR 00110011 = ? [DoICT ANE 2019]

a. 10111111

b. 00100011

c. 01010101

d. 11111111

Answer: a. 10111111

Explanation: Bitwise OR:

$$10101111 \mid 00110011 = 10111111$$

4. Which circuit can store 1 bit of data? [DoICT ANE 2019]

a. Register

b. Encoder

c. Decoder

d. Flip-flop

1 bit flip flop

Website: <https://duranta.app/>

Answer: d. Flip-flop

Explanation: A flip-flop is a digital memory element used to store a single bit (0 or 1). It is the fundamental building block of memory systems, used in registers and RAM.

5. 10000000 এর 2's Complement মান কত (8-bit)? [DoICT AP 2020]

- psi meey*
- A. 0
 - B. 128
 - C. -128
 - D. 256



Answer: M (-128)

Explanation: 10000000 → MSB is 1 → So it's a negative number. In 8-bit 2's complement representation:

Step-by-step:

Start with 10000000 ✓
 Invert all bits: 01111111 ✓
 Add 1: 01111111 + 1 = 10000000 ✓
 So, the positive equivalent is 128
 Therefore, the original number is: -128
 10000000 = -128
 The range for 8-bit signed numbers is -128 to 127.

negative
 @ 128

OSI/TCP/IP Data Communication

Computer Networking and Security 281

Protocol hierarchies; Data link control; HLDC; DLL in Internet; DLL of ATM; LAN Protocols; Standards IEEE 802.*; Hubs, Bridges, and Switches, FDDI, Fast Ethernet; Routing algorithm; Congestion control; Internetworking, WAN; Fragmentation; Firewalls; IPV4, IPV6, ARP, RARP, Mobile IP, Network layer of ATM; Transport protocols; Transmission control protocol; connection management, transmission policy, congestion control, timer management; UDP; AAL of ATM; Network security: Cryptography, DES, IDEA, public key algorithm; Authentication; Digital signatures; Gigabit Ethernet; Domain Name System: Name servers; Email and its privacy; SNMP; HTTP; World Wide Web.

Networking information security

Computer Network and Internet 971

Protocol, fundamentals of control protocol, Introduction and network types, LAN, MAN, WAN. Topologies: Star, switched, bus, ring. Ethernet LAN standards. Internetworking: Network interconnection, bridges, routers. Network layer protocols: IP, ARJP, ICMP, IP addresses. Unicast and multicast routing protocols. IPV6 congestion control, Transport layer protocol: TCP and UDP. Introduction to wireless LAN, VSAT, analog and digital cellular system. Network security: Types of attack, encryption techniques and digital signatures, Cryptography = encryption, decryption, ATM protocol; DNS, HTTP, Email.

Link span DSL

Computer Network

✓ 1. DNS port number is: [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) 63 খ) 21 গ) 53 ঘ) 24

Answer: গ) 53

Explanation: Port 53 is used for DNS (Domain Name System) services.

Must remember: HTTP, FTP, SMTP, telnet etc

✓ 2. Who is controlling "Domain" in the world? [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) CCNA খ) WWW3 গ) ICANN ঘ) ISDN

Answer: গ) ICANN

Explanation: ICANN (Internet Corporation for Assigned Names and Numbers) manages the domain name system.

3. Count-to-infinity problem occurs in [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

✓ ক) Distance vector routing খ) shortest path first গ) Link state routing ঘ) Hierarchical routing

Answer: ক) Distance vector routing

Explanation: Count-to-infinity is a problem in distance vector routing protocols like RIP.

Link state routing protocol: Open Shortest Path First (OSPF)

Intermediate System to Intermediate System (IS-IS)

Shortest Path First Algorithm (Dijkstra algorithm)

4. Which of following statements is connected with managed switch? [সাধারণ পুলের আওতায়

সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

✓ ক) It can configure each port differently and make VLAN

খ) It can manage traffic like a router

গ) It can ensure transport layer security ঘ) None of the above

Answer: ক) It can configure each port differently and make VLAN

Explanation: Managed switches support VLANs and per-port configuration.

5. Routing is clearly the major issue for: [AME-Gen. Pull-2019]

A. Transport layer

Website: <https://duranta.app/>

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

Routing - Network device

Answer: B

Explanation: The network layer in the OSI model is responsible for determining how data is transferred between network devices and choosing the best path for data routing from source to destination. Protocols like IP (Internet Protocol) and routing algorithms such as RIP, OSPF, and BGP operate at this layer to ensure proper data forwarding between networks.

6. To prevent __ we use firewall. [AME-Gen. Pull-2019]

- A. Data-driven attack
- C. Virus attack
- D. Unauthorized attack
- D. All

Answer: D

Explanation: A firewall acts as a barrier between a trusted internal network and an untrusted external network. It is designed to block or allow traffic based on a set of security rules. Firewalls can prevent data-driven attacks (malicious payloads), virus propagation, and unauthorized access to or from private networks, thereby ensuring network security. That's why all options are valid threats it can prevent.

7. Bridge is a __ device. [AME-Gen. Pull-2019]

- A. Layer-2
- B. Layer-3
- C. Layer-1
- D. Layer-2 and 3

*Layer-1: hub, repeater, Bridge
 Layer-2: Switch, Bridge
 Layer-3: Router, Gateway*

Answer: A

Explanation: A network bridge operates at Layer 2 (Data Link Layer) of the OSI model. It is used to connect two segments of a network and filter traffic based on MAC addresses. Unlike routers (Layer 3) which deal with IP addresses, bridges do not perform routing but do forward data intelligently at the frame level.

Layer -1 :Physical Layer: hub, repeater.

Layer-2: Switch, Bridge

Layer-3: Router ,Gateway

$$2^8 = 256 - 2 - 1 = 254$$

8. Which class of IP address provides a maximum of only 254 host address per network ID? [AME-Gen. Pull-2019]

- A. Class A
- B. Class B
- C. Class C
- D. Class D

*2^8 = 254
 8*

special computer & ICT class C 8

Answer: C

Explanation: IP address classes are defined by the number of bits reserved for the network and

Website: <https://duranta.app/>

host parts. Class C addresses have 24 bits for network and 8 bits for host. That gives $2^8 = 256$ total addresses per network. Since 2 addresses are reserved (one for the network ID and one for the broadcast address), only 254 addresses are available for hosts. Hence, Class C networks are used for small-sized networks.

10. How long is an IPv6 Address? [AME-Gen. Pull-2019]

- A. 32-bit
- B. 128-bytes
- C. 64-bits
- D. 128-bits

Answer: D

Explanation: An IPv6 address is 128 bits (not bytes) in length. This provides a vastly larger address space compared to IPv4 (32-bit). IPv6 addresses are written as 8 groups of 4 hexadecimal digits separated by colons, e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334.

11. Which one of the following is a private network based on public network? [AME-Gen. Pull-2019]

- A. Local Area Network
- B. Virtual Private Network
- C. Storage Area Network
- D. Enterprise Private Network

Answer: B

Explanation: A VPN (Virtual Private Network) allows secure connections over a public network (like the internet) by creating an encrypted tunnel between the user's device and the network. This ensures privacy and security for private data transmission.

Question 63

12. What type of DHCP discover message? [DoICT ANE 2019]

- a. Unicast
- b. Multicast
- c. Broadcast
- d. Anycast

Answer: c. Broadcast

Explanation: A DHCP Discover message is sent using broadcast because the client initially doesn't have an IP address and doesn't know the DHCP server's address. So, it uses broadcast to reach all devices on the network.

13. Which is a private IP address? [DoICT ANE 2019]

- a. 192.169.10.10
- b. 11.5.10.10
- c. 1.1.1.1

Website: <https://duranta.app/>

d. 172.16.5.3

Answer: d. 172.16.5.3

Explanation: According to RFC 1918, the private IP ranges are:

10.0.0.0 – 10.255.255.255

172.16.0.0 – 172.31.255.255

192.168.0.0 – 192.168.255.255

Option d falls in the valid private address range.

14. To determine IP address from MAC address? [DoICT ANE 2019]

- a. RIP
- b. BGP
- c. ARP
- d. TCP

Answer: c. ARP

Explanation: ARP (Address Resolution Protocol) is used to map an IP address to a MAC address in local networks. For reverse (MAC to IP), Reverse ARP (RARP) is used, although rarely today.

protocol, IP address
OS

Operating System 971

Introduction, evolution, goals and components of OS. Types of OS Process management: Process states, PCB, job and process scheduling. CPU scheduling algorithms, critical section problems and solutions. Semaphores, Inter-process communication techniques. Deadlock handling methods. deadlock, banker's algorithm. Memory management techniques: Paging, segmentation and page replacement policies. (FIFO, LIFO, LRU) Secondary storage management. Disk scheduling algorithms. Kernel, Shell File management: File system structure, organization, FCB, space allocation, tree structured file system. Protection and security: classification and handling techniques.

thread, system call

Operating System 281

Operating System: its role in computer systems; Operating system concepts; Operating system structure; Process: process model and implementation, Inter-Process Communication (IPC), classical IPC problems, process scheduling, multiprocessing and time-sharing; Memory management: swapping, paging, segmentation, virtual memory; Input/Output: hardware, software, disk, terminals, clocks; Deadlock: resource allocation and deadlock, deadlock detection, prevention and recovery; File Systems: files, directories, security, protection; Case study of some operating systems.

Semaphore

Operating System

Website: <https://duranta.app/>

1. Time during which a job is processed by the computer is; [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

- ক) Delay time
- খ) Real time
- গ) Execution time
- ঘ) Process time

Answer: গ) Execution time

Explanation: Execution time is the time during which the CPU actively processes instructions of a job.

2. What is the relationship between paging and virtual memory? [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

- ক) Virtual memory came before paging
- খ) When pages are created in disks, it is called a virtual memory
- গ) Virtual memory can never be implemented without paging
- ঘ) Both have the same concepts

Answer: খ) When pages are created in disks, it is called a virtual memory

Explanation: Virtual memory allows the system to use disk space to simulate extra RAM, and paging is the method by which this is implemented.

3. The scheduling queue is generally stored as- [AME-Gen. Pull-2019]

- A. A linear array
- B. A stack
- C. A linked list
- D. A tree

Answer: C

Explanation: In operating systems, queues like ready or wait queues are implemented using linked lists because of their dynamic nature and efficiency in inserting/removing elements from any position without shifting elements like in arrays.

4. Who presides the interface between a process and the OS? [AME-Gen. Pull-2019]

- A. Kernel
- B. System calls
- C. Command interpreter
- D. Graphical user interface

Answer: B

Explanation: System calls provide the interface through which a user process communicates with the operating system kernel. They allow programs to request OS services like reading from a file, creating a process, or allocating memory.

Schedulgr
LI syst
SJF, SRTF, Round Robin
Linux proc- Ba

Website: <https://duranta.app/>

5. The request and release of resources are- [AME-Gen. Pull-2019]

- A. Command line statements
- B. Interrupts
- C. System calls
- D. Special programs

Answer: C

Explanation: In an operating system, when a process needs to use or release resources (e.g., memory, files, or devices), it does so by making a system call, which invokes OS services to handle the request safely and efficiently.

6. To execute a program, an OS creates a number of ___ each one for running a different program. [AME-Gen. Pull-2019]

- A. Processors
- B. Threads
- C. Virtual Processors
- D. Kernel

Answer: B

Explanation: Threads are the smallest units of CPU execution. An OS may create multiple threads to execute parts of a program concurrently. For multitasking, the OS may run multiple programs by creating multiple threads or processes.

Database Management System 971

Definition of DBMS, types of DBMS, its advantages and disadvantages, Data model: ER model and relational model. Integrity constraints. Functional dependencies. Assertions and triggers. File organization: Definition of various file organization, classification and Representation. Indexing techniques: sparse and dense indexing. B+ tree indexing, hash indexing. Relational database design: normalization, 2NF, 3NF and BCNF. Query processing: Various notations, cost estimation of selection operation and join operation. Transaction concept and concurrency control: Lock based protocol, deadlock handling. SQL and application using SQL.

Data Com

45%

Database Systems 281

Concepts of database systems; Data Models: Entity-Relationship model, Relational model; Query Languages: Relational algebra, SQL; Constraints and triggers; Functional dependencies and normalization; File organization and data storage; Indexing: primary and secondary indexes, B+ trees, hash tables; Query optimization; Transaction management; Recovery; Concurrency control; Access control and security; Semi structured database: XML, XPath, XQuery; Object oriented and object relational databases

OS data Artificial ICT 2 physics software electronics elec

Database Management Systems (DBMS)

Website: <https://duranta.app/>

1. The key selected from the sets of candidate keys by database design is called----key:

[সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Candidate খ) Primary গ) Super ঘ) Foreign

Answer: খ) Primary

Explanation: The primary key is the chosen unique identifier for records in a table, selected from the candidate keys.

2. To remove a relational table from SQL database, we use [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Delete খ) Purge গ) Remove ঘ) Drop

Answer: ঘ) Drop

Explanation: The SQL DROP command is used to completely remove a table or database structure.

3. Which of the following types of table constraints prevents the entry of duplicate rows?

[সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Foreign keys খ) Primary keys গ) Unique keys ঘ) Candidate keys

Answer: খ) Primary keys

Explanation: A Primary Key constraint ensures that: No two rows can have the same value in the primary key column(s). It also does not allow NULL values. Therefore, it guarantees uniqueness and row identity, effectively preventing duplicate rows.

4. "There must not be any partial dependency" – Which Normal Form holds this condition? [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) 1NF খ) 2NF গ) 3NF ঘ) BCNF

Answer: খ) 2NF

Explanation: Second Normal Form (2NF) eliminates partial dependencies, meaning no non-prime attribute is dependent on a part of a composite primary key.

- **Partial Dependency** মানে হলো কোনো non-prime attribute যদি composite primary key-এর আংশিক অংশের উপর নির্ভর করে, তাহলে সেটা partial dependency.

► 1NF (First Normal Form):

- শুধুমাত্র এটুকু নিশ্চিত করে যে প্রতিটি অ্যাট্রিবিউটে atomic (অর্থাৎ indivisible) value আছে।
- এখানেই repeat group, multi-valued attribute ইত্যাদি সরানো হয়।

► 2NF (Second Normal Form):

- 1NF মেনে চলতে হবে।
- সাথে কোনো partial dependency থাকা যাবে না।
- অর্থাৎ, non-prime attributes must depend on the entire primary key, not a part of it.

Website: <https://duranta.app/>

► **3NF (Third Normal Form):**

- 2NF satisfied হতে হবে।
- সাথে **no transitive dependency** থাকতে পারবে না।

► **BCNF (Boyce-Codd Normal Form):**

- এটা 3NF-এর একটি বিশেষ কেস।
- যেখানে প্রতিটি functional dependency-র left side অবশ্যই একটি super key হতে হবে।

উদাহরণ:

ধরা যাক, একটি relation আছে:

Student_Course (StudentID, CourseID, CourseName)

Primary Key: (StudentID, CourseID)

এখানে যদি CourseName কেবলমাত্র CourseID-এর উপর নির্ভর করে, তাহলে এটি **partial dependency**, কারণ CourseName পুরো primary key (StudentID, CourseID)-এর উপর নির্ভর করছে না। এই অবস্থায় relation টি **2NF**-এ নেই।

5. Which is known as database aggregate function? [DoICT ANE 2019]

- where
- sum
- select
- from

Answer: b. sum

Explanation: SUM is an aggregate function in SQL used to calculate the total of a numeric column. Other aggregate functions include COUNT, AVG, MIN, and MAX. WHERE, SELECT, and FROM are SQL clauses, not aggregate functions.

6. Which is represented as uniqueness of a database table? [DoICT ANE 2019]

- Primary key
- Foreign key
- Entity
- Relation

Answer: a. Primary key

Explanation: A primary key is a field (or combination of fields) in a table that uniquely identifies each record. It cannot have NULL values and ensures data integrity. Foreign keys reference primary keys in other tables.

7. নিচের কোনটি একটি Database Aggregate Function? [DoICT AP 2020]

- Where
- Sum
- Select
- From

Answer: B (Sum)

Website: <https://duranta.app/>

Explanation: Aggregate functions in databases perform calculations on multiple rows. SUM() is used to calculate the total of numeric values. Others include COUNT(), AVG(), etc.

৪. কোনটি Database টেবিলে Uniqueness নিশ্চিত করে? [DoICT AP 2020]

- A. Relation
- B. Entity
- C. Primary key
- D. Foreign key

Answer: C (Primary key)

Explanation: A Primary Key is used to uniquely identify each record in a database table. No two rows can have the same value for the primary key column(s).

Data Structures 971

Arrays: Representation and operations. Sparse and dense matrices: Concept and operation. Stacks and queues: Concept, structures and basic operations. Quick-sort and Polish notation: Applications of stack. Recursion: Concept and applications. Linked lists: Representation and various operations. Trees: Binary trees, traversing binary trees. Binary search trees: Various operations. Binary heaps: Heap sort. Huffman's algorithm. Graphs: Representations and operations. Spanning trees, shortest path and topological sorting. Internal sorting: Insertion sort, selection sort, merge-sort, radix sort, Basic hashing techniques.

Algorithm Analysis 971

Algorithm and complexity. Asymptotic notations, Basic algorithm techniques and analysis, Divide and conquer, Dynamic programming, greedy method, branch and bound, string matching, computational geometric problems, graph algorithms, spanning trees, shortest paths, max-flow problem, searching algorithms. Techniques for analysis of algorithms, approximation algorithms, parallel algorithms.

Data Structures and Algorithms 281

Internal data representation; Abstract data types; Elementary data structures: arrays, lists, stacks, queues, trees, graphs; Advanced data Structures: heaps, Fibonacci heaps, B-trees; Recursion, sorting, searching, hashing, storage management. Techniques for analysis of algorithms; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound; Basic search and traversal techniques; Topological sorting; Connected components, spanning trees, shortest paths; Flow algorithms;

Algorithm Analysis 281 Approximation algorithms; Parallel algorithms; Algebraic simplification and transformations; Lower bound theory; NP-completeness, NP-hard and NP-complete problems.

CSE

Data Structures and Algorithms

1. Quick sort algorithm is an example of —[সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Greedy approach খ) Improved binary search গ) Dynamic programming ঘ) Divide and conquer

Answer: ঘ) Divide and conquer

Explanation: Quick sort uses the divide and conquer technique, dividing arrays into partitions recursively.

2. What is the worst-case time complexity of linear search algorithm? [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) $O(1)$ খ) $O(n)$ গ) $O(\log n)$ ঘ) $O(n^2)$

Answer: খ) $O(n)$

Explanation: In linear search, the algorithm may have to check every element once in the worst case, making it $O(n)$.

3. Which of the following data structures follows the LIFO principle? [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Stack খ) Linked list গ) Queue ঘ) Graph

Answer: ক) Stack

Explanation: Stack follows the Last-In, First-Out (LIFO) principle, where the last inserted element is removed first.

4. If we have a very small amount of additional memory, but a large number of items to sort, which of the following sorting algorithm should we use? [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Merge sort খ) Heap sort গ) Bubble sort ঘ) Bogo sort

Answer: খ) Heap sort

Explanation: Heap sort is memory-efficient, requiring only constant space and no recursion, making it ideal for limited memory.

5. In which of the following graphs can we apply topological sort? [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Undirected Cyclic graph

খ) Directed Cyclic graph

গ) Undirected Acyclic graph

ঘ) Directed Acyclic graph

Website: <https://duranta.app/>

Answer: ঘ) Directed Acyclic graph

Explanation: Topological sorting is only valid for Directed Acyclic Graphs (DAGs) as they have no cycles and maintain dependency order.

✓ **6. Which of the following search algorithm requires less memory?** [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Optimal Search খ) Breadth-First Search গ) Depth-First Search ঘ) Linear Search

Answer: গ) Depth-First Search

Explanation: DFS uses a stack and generally consumes less memory than BFS, which requires storing a queue of nodes.

Question 21

✓ **7. Complete Binary Tree এর height যদি n হয়, তাহলে সর্বোচ্চ কতটি node থাকবে?** [DoICT AP 2020]

- A. n
- B. $2n$
- C. $2n - 1$
- D. $2^{n+1} - 1$

Answer: D ($2^{n+1} - 1$)

Explanation: A complete binary tree of height n can have up to $2^{n+1} - 1$ nodes. This includes all nodes from level 0 to level n completely filled.



8. Array data structure এ কোন ধরনের ডেটা রাখা হয়? [DoICT AP 2020]

- A. একই ধরনের সকল ডেটা
- B. বিভিন্ন ধরনের ডেটা
- C. প্রিন্টারের ডেটা
- D. ক্লাস এর ডেটা

Answer: A (একই ধরনের সকল ডেটা)

Explanation: Arrays are used to store a collection of elements of the same type (e.g., all integers or all floats), which allows indexed access and efficient memory use.

9. What is the time complexity of binary search tree (average case)? [DoICT ANE 2019]

- A. $O(n)$
- B. $O(n \log_2 n)$
- C. $O(\log_2 n)$
- D. $O(n^2)$

Answer: c. $O(\log_2 n)$

Explanation: In an average case, searching in a balanced binary search tree (BST) takes $O(\log n)$ time, as it splits the tree in half each time. Worst-case complexity becomes $O(n)$ if the tree becomes skewed (like a linked list).

Website: <https://duranta.app/>

10. নিচের কোনটি একটি valid Postfix expression? [DoICT AP 2020]

- A. $ab(c+d)$
- B. $abc+de-+$
- C. $+ab$
- D. $a+b-c$

Answer: B ($abc+de-+$)

Explanation: A postfix expression (also called Reverse Polish Notation) places operators after the operands. The correct structure doesn't use parentheses and respects operator precedence.

Example:

$abc*+de-+ = ((a + (b * c)) + (d - e))$

ex →
o In order
pre order
post order

11. Which is represented by graph? [DoICT ANE 2019]

- a. Queue
- b. Stack
- c. Adjacency list
- d. Pointer

Answer: c. Adjacency list

Explanation: An adjacency list is a common data structure used to represent graphs. It stores a list of nodes and their neighbors, allowing efficient representation of sparse graphs.

12. Which data is kept in array data structure? [DoICT ANE 2019]

- a. Various type data
- b. Pointer data
- c. Class data
- d. Similar data

Answer: d. Similar data

Explanation: In C and most programming languages, an array stores elements of the same data type (e.g., all int or all float). This allows efficient indexing and memory management.

13. What is the time complexity of binary search tree (average case)? [DoICT ANE 2019]

- a. $O(n)$
- b. $O(n \log_2 n)$
- c. $O(\log_2 n)$
- d. $O(n^2)$

Answer: c. $O(\log_2 n)$

Explanation: In an average case, searching in a balanced binary search tree (BST) takes $O(\log n)$ time, as it splits the tree in half each time. Worst-case complexity becomes $O(n)$ if the tree becomes skewed (like a linked list).

14. Which is known as LIFO data structure? [DoICT ANE 2019]

- a. Queue
- b. Stack
- c. File

Website: <https://duranta.app/>

d. None

Answer: b. Stack

Explanation: A stack follows the Last In, First Out (LIFO) principle, meaning the last element added is the first to be removed. It supports operations like push() and pop(). It is used in recursion, expression evaluation, etc.

15. Max number in max heap is located where? [DoICT ANE 2019]

a. Leaf

b. Root

c. Outside

d. Internal

Answer: b. Root

Explanation: A max heap is a binary tree where the root node contains the largest element. Every parent node is greater than or equal to its children, ensuring the maximum value is always at the root.

→ root
→ root

Computer Organization and Architecture 971

Fundamentals of computer design. Processor and ALU design. Control design: Hardware control and micro-programmed control. Caches Memory organization. Exceptions System organization Bus and hazards I/O subsystem and I/O processor. Parallel processing: Concept, pipeline processors. Interrupts systolic arrays and fault-tolerant computers

five DLX pipeline parallel process

Hazards ALU

Computer Architecture 281

Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Arithmetic Logic Unit (ALU) operations, floating point operations, designing ALU; Processor design: data paths & single cycle and multicycle implementations; Control Unit design - hardwired and microprogrammed; Hazards; Exceptions; Pipeline: pipelined Datapath and control, superscalar and dynamic pipelining; Memory organization: cache, virtual memory, channels.

Flynn's classification

Computer Architecture/Organization

1. are used to quickly accept, store and transfer data and instructions that are being used immediately by the CPU. [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Graphics খ) RAMs গ) Caches ঘ) Register

Answer: ঘ) Register

Explanation: Registers are the fastest type of memory, used directly by the CPU for immediate data processing.

Website: <https://duranta.app/>

2. If a processor has 8-bit register, what is the value of $(11111111)_2$ in 2's complement? [সাধারণ পুনের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) 255 খ) -1 গ) 256 ঘ) 0

Answer: খ) -1

Explanation: In 8-bit 2's complement, 11111111 represents -1. To find the value, invert the bits and add 1. Invert: 00000000, Add 1: 00000001 → which is 1 in decimal. Therefore, the original number is -1.

Question 98

3. What is used as virtual memory beside RAM? [DoICT ANE 2019]

- a. Cache
- b. CPU register
- c. CD-ROM
- d. Hard disk

Answer: d. Hard disk

Explanation: Virtual memory is implemented using the hard disk to temporarily hold data that cannot be stored in RAM due to capacity limitations. The OS swaps data between RAM and disk using a paging mechanism.

100 — 040 dept

✓ **Discrete Mathematics:** Propositional and predicate calculus: Basic concept. ✓ Theory of sets: set operations, algebra of sets. ✓ Mathematical induction. ✓ Basic concept of relations and its representation. ✓ Functions and its classification and pictorial representation. ✓ Graph theory and its application. ✓ Elementary number system. ✓ Principles of counting. ✓ Reversion, generating, functions, recurrence relation.

Discrete Mathematics

pigeonhole

1. Two sets are called disjoint if their is an empty set. [সাধারণ পুনের আওতায় সহকারী প্রোগ্রামার

ক) Union খ) Difference গ) Intersection ঘ) Complement

Answer: গ) Intersection

Explanation: Two sets are disjoint if they have no elements in common. The intersection of such sets is the empty set (\emptyset).

Artificial Intelligence 281

Introduction to old and new AI techniques; Knowledge representation; Propositional and first order logic; Search techniques in AI; Probabilistic reasoning; Natural language processing. Introduction to expert system. Introduction to machine learning; Learning algorithms: supervised and unsupervised; Practical application of machine learning; Regression; Clustering.

Artificial Intelligence:

৩৪১

Website: <https://duranta.app/>

Overview of AI. General concepts of knowledge. Introduction to PROLOG. Knowledge representation. Intelligent agents. First order logic. Knowledge organization and manipulation: Search strategies, matching techniques and game planning. Natural language processing, Probabilities reasoning, expert systems and computer vision, Knowledge acquisition: Learning in symbolic and non-symbolic representation.

Artificial Intelligence

1. What is Artificial Intelligence? [সাধারণ পুনের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

- ক) Making a machine intelligent
- খ) Putting your intelligence into computer
- গ) Programming with your own intelligence
- ঘ) Putting more memory into computer

Answer: ক) Making a machine intelligent

Explanation: AI involves building systems capable of performing tasks that require human-like intelligence, such as reasoning, learning, and decision-making.

2. What is the environment of Chess Game? [DoICT ANE 2019]

- a. Stochastic
- b. Fully observable ✓
- c. Partially observable
- d. None

Answer: b. Fully observable

Explanation: In chess, all pieces and moves are visible to both players. There is no hidden state or randomness in the environment, making it a fully observable and deterministic environment.

3. Which is a genetic algorithm operator? [DoICT ANE 2019]

- a. Mutation ✓
- b. Population
- c. Gene
- d. Individual

Answer: a. Mutation

Explanation: In genetic algorithms, mutation introduces random changes in individuals to maintain diversity in the population. It helps the algorithm avoid local minima and explore new solutions.

4. Hill Climbing Search এর প্রধান সমস্যা কোনটি? [DoICT AP 2020]

- A. Local Maxima
- B. Infinite loop
- C. No solution ✓
- D. Slowness

Answer: C (No solution)

Explanation: Hill Climbing is a greedy algorithm that moves towards the goal by choosing the best neighbor. The major issue is that it may get stuck at a local maximum, which is not the global solution.

2 → (b)

8086
2/1

Microprocessor and Interfacing 281

Introduction to microprocessor: overview of computer architecture, evolution of microprocessors, difference between microprocessor and microcontroller; Introduction to 8086/8088: basic architecture of 8086, memory segmentation, flags, addressing modes, pins & signals, single and multi-processor systems; Microprocessor programming: instruction sets, introduction to assembly language programming; Tools: assemblers, debuggers, development systems; Clock and bus controller interfacing: clock generator, bus demultiplexer, bus controller interfacing; Memory Interfacing: SRAM and EEPROM interfacing, Types of I/O: parallel I/O, programmed I/O, interrupt driven I/O, I/O port address decoding, programmable peripheral interface (8255A), interface examples- Keyboard matrix, LCD/7-Segment display, printer, stepper motor, A/D and D/A converter; Timer interfacing: The 8254 programmable interval timer (PIT), timing applications; Serial I/O interface: asynchronous and synchronous communication, physical communication standard-EIA RS232, programmable communication interface, interfacing serial I/O devices- mouse, modem, PC Keyboard; Interrupts: interrupt driven I/O, software & hardware interrupts, interrupt vectors and vector table, interrupt processing, programmable interrupt controller (8259A), DMA: DMA controller (8237).

DLI
opcode
ADD AL, B

JBE (INC) JMP

Microprocessor and Interfacing 281

Microprocessor and microcomputers. Evolution of microprocessor. Architecture of a general-purpose microprocessor and its operation. Addressing modes. Common instruction types: Basic assembly instruction set. Intel 8086 microprocessor: Internal architecture, register structure, programming model, addressing modes and instruction sets. Interrupts its classification and interrupt handling, Memory management in Intel 80x86 family: Real-mode memory management, segmentation and segmented to physical address translation. Protected mode memory management: Segmentation and virtual addressing, segment selectors and descriptors and tables. Intel 80386 and 80486 register formats. Paged memory operation and TLB structure I/O port organization and accessing. Interfacing the keyboard, printer and monitor. Structure and operation of certain chips as 8255A, 8253, 8272, 8259A, 8237. Bus interfaces and micro controllers.

Microprocessor and Interfacing

1. How many 16-bit registers are present in Intel 8086 microprocessor? [DoICT ANE 2019]

- a. 4
- b. 8
- c. 14
- d. 16

Answer: (b) 8

Explanation. The Intel 8086 has 8 general-purpose 16-bit registers: AX, BX, CX, DX, SI, DI, BP, and SP. These registers are used for arithmetic, data manipulation, and addressing.

Website: <https://duranta.app/>

2. Intel 8086 মাইক্রোপ্রসেসরের Address Bus এর প্রস্থ কত? [DoICT AP 2020]

- A. 8-bit
- B. 16-bit
- C. 20-bit
- D. 32-bit

20 bit

Answer: M (20-bit)

Explanation: The 8086 microprocessor has a 20-bit address bus, allowing it to access $2^{20} = 1\text{MB}$ of memory. This is separate from its 16-bit data bus.

3. Microprocessor এ ALU কোন ইউনিটের অধীনে কাজ করে? [DoICT AP 2020]

- A. Fetch unit
- B. Control unit
- C. Processing unit
- D. Flags unit

CPU

Answer: C (Processing unit)

Explanation: The Arithmetic Logic Unit (ALU) is a core part of the Processing Unit. It performs all arithmetic and logical operations within the microprocessor.

Electrical Circuits

Circuit variables and elements: voltage, current, power, energy, independent and dependent sources, resistance; Basic laws of electrical circuits: Ohm's law, Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL); Simple resistive circuits: series and parallel circuits, voltage and current division, source transformation; Methods of analysis: nodal and mesh analysis; Circuit theorems: Thevenin's, Norton's and superposition theorems, maximum power transfer and reciprocity theorem; Capacitors and inductors: inductors and capacitors, their characteristics, series-parallel combination of inductors and capacitors; RLC Transients. Series and parallel AC circuits: impedance and phasor diagram, series and parallel networks, voltage divider rule, admittance and susceptance; mesh and nodal analysis, wye-delta and delta-wye conversions; superposition theorem, Thevenin 's theorem, Norton 's theorem, maximum power transfer theorem.

281

Electrical Circuits

1. The rating of fuse is expressed as [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

- ক) Ampere-hours খ) Ampere-volts গ) KWH ঘ) Amperes

Answer: ঘ) Amperes

Explanation: Fuse rating is measured in amperes (A), indicating the maximum current it can safely carry without blowing.

Website: <https://duranta.app/>

2. A loss-less transmission line has $L=8.5 \text{ nH/m}$ and $C=300 \text{ pF/m}$. What is the characteristic impedance? [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) 50Ω খ) 5.32Ω গ) 8.92Ω ঘ) 4.32Ω

Answer: খ) 5.32Ω

Explanation: $Z_0 = \sqrt{L/C} = \sqrt{(8.5 \times 10^{-9} / 300 \times 10^{-12})} = \sqrt{(28.33)} \approx 5.32\Omega$.

3. The total charge entering a terminal given by $q=5t\sin(4\pi t) \text{ mC}$. What is the current at $t=0.5\text{S}$? [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) 3.142 mA খ) 31.42 mA গ) 28.37 mA ঘ) 8.34 mA

Answer: খ) 31.42 mA

Explanation: $i(t) = dq/dt = d/dt [5t \cdot \sin(4\pi t)] \rightarrow$ Use product rule. At $t=0.5$, result = $0.03142 \text{ A} = 31.42 \text{ mA}$.

4. A nuclear power plant is invariably used as a plant. [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Peak load খ) Base load গ) Standby ঘ) Spinning reserve

Answer: খ) Base load

Explanation: Nuclear power plants operate continuously and supply the base load due to their efficiency and low fuel cost.

Electrical Circuits

Question 9

Question: The concept on which Superposition theorem is based on-

Source: [AME-Gen. Pull-2019]

Options:

K. reciprocity

L. duality

M. non-linearity

N. linearity

Answer: N

Explanation: The superposition theorem states that in a linear circuit with multiple sources, the total current or voltage at any point is the algebraic sum of the currents or voltages caused by each independent source acting alone. This principle only applies to linear systems, which means the response is directly proportional to the input.

Question 16

Question: A load is connected to a network. At the terminal to which the load is connected, $R_{th} = 10\Omega$ and $V_{th} = 40\text{V}$. The maximum possible power supplied to the load is:

Source: [AME-Gen. Pull-2019]

Options:

K. 160 W

L. 80 W

M. 40 W

N. 1 W

Answer: M

Explanation: The maximum power transfer theorem states that power is maximized when the load resistance equals the Thevenin resistance (R_{th}).

Formula:

$$P_{max} = (V_{th}^2) / (4 \times R_{th}) = (40^2) / (4 \times 10) = 1600 / 40 = 40 \text{ W}$$

Basic Electronics

Diode circuit: current-voltage characteristics of a diode, DC and AC models, dynamic resistance and capacitance, load line, Zener regulator, half wave and full wave rectifier, voltage multiplier, clipper and clamper; Bipolar junction transistors: construction and operation, amplifying action, common base, common emitter, common collector, load line, different biasing, stability factor, small signal equivalent circuit models, BJT as a switch; Single stage amplifier: voltage and current gain, input and output impedance of a common base, common emitter and common collector, h -parameter; Field effect transistor (FET): JFET structure, operation and characteristics. MOSFET construction, operation and characteristics.

Basic Electronics

1. Which configuration of Bipolar Junction Transistor is known as voltage follower? [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

ক) Common collector খ) Common base গ) Common emitter ঘ) None of them

Answer: ক) Common collector

Explanation: The common collector (also known as emitter follower) configuration offers unity gain and high input impedance, ideal as a voltage buffer.

2. Generally the gain of a transistor amplifier falls at high frequency due to the[সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Internal capacitance of the device খ) coupling capacitor at the input গ) Skin effect ঘ)

Coupling capacitor at the output

Answer: ক) Internal capacitance of the device

Explanation: At high frequencies, internal capacitances in a transistor reduce gain as they act as low-pass filters.

Website: <https://duranta.app/>

3. Which of the following statement holds true for the divergence of electric and magnetic flux densities? [সাধারণ পুনের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Both are zero খ) These are zero for static flux densities but non-zero for time varying flux densities গ) It is zero for electric flux densities ঘ) It is zero for magnetic flux densities

Answer: খ) These are zero for static flux densities but non-zero for time varying flux densities

Explanation: According to Maxwell's equations, divergence of electric flux density is non-zero for time-varying fields, and divergence of magnetic field is always zero.

4. A voltage source supplies a constant signal (0-40kHz) to an RC low-pass filter.

Maximum voltage is at... [সাধারণ পুনের আওতায় সহকারী প্রোগ্রামার ২২]

ক) 10 kHz খ) 40 kHz গ) 18 kHz ঘ) DC

Answer: ঘ) DC

Explanation: Low-pass filters pass DC and low-frequency signals, blocking high-frequency ones.

5. When a step signal input is applied to an op-amp integrator, the output will be... [সাধারণ পুনের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) A Ramp খ) A sinusoidal wave গ) A Rectangular Wave ঘ) A triangular wave with DC bias

Answer: ক) A Ramp

Explanation: An op-amp integrator outputs a ramp waveform when given a step input because integration of a constant (step) yields a ramp.

6. The transfer function of an LTI system is given as $1/(s+2)$. What is the value of its impulse response at $t=0$? [সাধারণ পুনের আওতায় সহকারী প্রোগ্রামার ২২]

ক) 0.0 খ) 0.689 গ) 1.0 ঘ) 1.5

Answer: গ) 1.0

Explanation: Impulse response $h(t) = e^{-2t}$. At $t = 0$, $h(0) = e^0 = 1$.

7. A 4-pole 50Hz induction motor is running at 1300rpm. The speed of stator magnetic field with respect to rotor is [সাধারণ পুনের আওতায় সহকারী প্রোগ্রামার ২২]

ক) 1500 rpm খ) 200 rpm গ) 1300 rpm ঘ) 300 rpm

Answer: খ) 200 rpm

Explanation: Synchronous speed = $(120 \times 50)/4 = 1500$ rpm; Rotor speed = 1300 \rightarrow Difference = 200 rpm.

8. For successful operation of two single-phase transformers connected in parallel, the most essential condition is that their--[সাধারণ পুনের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

ক) Percentage impedances are equal

Website: <https://duranta.app/>

- খ) Polarities are properly connected
 গ) Turns ratio are exactly equal
 ঘ) KVA ratings are equal

Answer: খ) Polarities are properly connected

Explanation: Mismatched polarity can cause circulating currents, damaging transformers when paralleled.

9. The applied voltage of a certain transformer is increased by 50%, while the frequency is reduced by 50%. The Maximum core flux density will [সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

- ক) become three times খ) become 1.5 times গ) become half ঘ) remain the same

Answer: ক) become three times

Explanation:

The maximum core flux density B_{max} depends on the applied voltage V and frequency f as:

$$B_{max} = \frac{V}{4.44 f N A}$$

If the voltage increases by 50% (1.5 times) and the frequency decreases by 50% (half), then:

$$B_{max,new} = \frac{1.5V}{4.44 \times 0.5f \times NA} = 3 \times B_{max}$$

Question 12

Question: At absolute zero temperature, semiconductor behaves as a/an

Source: [AME-Gen. Pull-2019]

Options:

- K. Good conductor
 L. Superconductor
 M. Insulator
 N. Variable resistor

Answer: M

Explanation: At absolute zero (0 Kelvin), all thermal motion ceases. In a semiconductor, this means that no free electrons are available to conduct electricity, as all electrons are bound in the valence band. Thus, it behaves like a perfect insulator. Only when temperature increases, thermal energy enables electrons to jump to the conduction band, allowing conduction.

Data Communication 971

Introduction to OSI and TCP/IP protocol. Data transmission basics: analog and digital data, spectrum and bandwidth. Transmission impairments. Data rate channel capacity. Transmission media: Twisted pair, coaxial cable and optical fiber, wireless transmission. Data encoding: NRZ, NRZI, Manchester and differential Manchester modulation techniques AM, FM, PM, Delta

wi Radio microwave



bit
band rate

Nyquist

Website: <https://duranta.app/>

modulation, compounding Equations, ASK, PSK, FSK, QPSK, QAM, sampling theorem, PCM, PPM, PAM. Data transmission: Synchronous and asynchronous and asynchronous, NULL modem configuration. Data link control error and flow control CRC and HDLC. Multiplexing: FDM, TDM, statistical TDM. Basic circuit switching and packet switching techniques.

16/2
5

Communication Theory 281

CRC

Spectral analysis: Fourier series, sampling function, power spectrum, Fourier transform, convolution, Parseval's theorem; Information theory: entropy, information rate, Shannon's theorem, channel capacity; Analog communication system: different modulations, modulation circuits and detectors; Digital modulation: different standard modulation schemes; Pulse and digital signals: pulse amplitude modulation (PAM), pulse code modulation (PCM), delta modulation (DM), adaptive delta modulation (ADM); Multiplexing: time-division multiplexing (TDM) frequency-division multiplexing (FDM), multiple-access network- time-division multiple-access (TDMA), frequency-division multiple access (FDMA); code division multiple-access (CDMA).

Communication Theory

1. The bandwidth of a channel is 1 MHz. The SNR for this channel is 63. What are the bit rate? [AME-Gen. Pull-2019]

- A. 4 Mbps
- B. 6 Mbps
- C. 8 Mbps
- D. 10 Mbps

Answer: B

Explanation: Using Shannon's Capacity formula:

$$C = B \times \log_2(1 + \text{SNR})$$

Where B = 1 MHz, SNR = 63

$$\log_2(1 + 63) = \log_2(64) = 6$$

$$\text{So, } C = 1 \times 6 = 6 \text{ Mbps}$$

Therefore, the maximum bit rate achievable without error due to noise is 6 Mbps.

2. AM signal bandwidth if carrier = 300 kHz, message = 3 kHz? [DoICT ANE 2019]

- a. 300 Hz
- b. 3 kHz
- c. 6 kHz
- d. 600 Hz

Answer: c. 6 kHz

Explanation: In Amplitude Modulation (AM), total bandwidth = 2 × message frequency (since both upper and lower sidebands are transmitted). So, 2 × 3 kHz = 6 kHz.

3. Which multiplexing technique transmits digital signals? [AME-Gen. Pull-2019]

- A. WDM

- B. FDM
- C. TDM
- D. All of the above

Answer: M

Explanation: Time Division Multiplexing (TDM) is a digital multiplexing technique in which multiple digital signals share a single transmission channel by taking turns (time slots). Each signal is allotted a specific time interval during which it can use the channel. This technique is efficient for digital signal transmission because it doesn't require frequency separation like FDM or optical bands like WDM.

Software Engineering 971

Introduction, Software process. Project management. Requirements engineering processes. System Models: Context, data, behavioral and object models: agile, waterfall model, prototype, SCRUM, Spiral; Object oriented design techniques: Model, UML use-case, class, Real-time software design. System design with reuse. Critical system design dependability, software maintenance, critical system specification and development Verification and validation. Software testing. Software cost estimation: COCOMO model Halstead formula. Graph: Cel analysis of complexity measures, software reliability and availability, Quality assurance.

Software Engineering and Information System Design 281

Concepts of Software Engineering, Software Engineering paradigms, Different phases of software System Development, Different types of information, qualities of information. Project Management Concepts, Software process and project Metrics, Software Project Planning, Risk Analysis and management, Project Scheduling and Tracking. Analysis Concepts and principles: requirement analysis, Analysis modeling, data modeling. Design concepts and principles, Architectural design, User Interface design, Object Oriented software development and design: Iterative Development and the Unified Process. Sequential waterfall life cycles, Inception. Use case model for requirement writing, Elaboration using System Sequence Diagram, Domain Model. Visualizing concept classes. UML diagrams, Interaction and Collaboration Diagram for designing Software. Designing Objects with responsibilities. GRASP patterns with General Principles in assigning responsibilities: Information expert, Creator, Low Coupling and High Cohesion, Creating design class diagrams and mapping design to codes. Software Testing: White Box and Black Box testing. Basis Path Testing. Testing for specialized environment. Software testing strategies: Unit Testing, Integration Testing, Validation Testing, System Testing, Art of debugging. Analysis of System Maintenance and upgrading: Software repair, downtime, error and faults, specification and correction, Maintenance cost models, documentation. Software Quality Assurance, Quality factors. Software quality measures. Cost impact of Software defects. Concepts of Software reliability, availability and safety. Function based metrics and bang metrics. Metrics for analysis and design model. Metrics for source code, testing and maintenance.

✓ 1. Input-output is understood by? [DoICT ANE 2019]

Options:

- a. Integration testing
- b. Black-box testing
- ✓ c. White-box testing
- d. Load testing

Answer: c. White-box testing

Explanation: White-box testing focuses on the internal logic of the code, including how input is processed and how output is generated. Testers have access to source code and test the flow and logic of functions, loops, and conditions.

2. Input-output এর জন্য কোন ধরনের টেস্টিং ব্যবহৃত হয়? [DoICT AP 2020]

- A. Black-box testing
- B. Integration testing
- ✓ C. White-box testing
- D. Load testing

Answer: M (White-box testing)

Explanation: In White-box testing, the tester examines internal code logic, including input-output flow, loops, and branches. This helps ensure correct processing inside the program.

✓ **Introduction to Computer Systems 281**

Introduction to computations; Early history of computing devices; Computers; Major components of a computer; Hardware: processor, memory, I/O devices; Software: Operating system, application software; Basic architecture of a computer; Basic Information Technology; The Internet; Number system: binary, octal, hexadecimal, binary arithmetic.

Q50: Which technology is used in Compact Disk (CD)? [সাধারণ পুলের আওতায় সহকারী প্রোগ্রামার ২২]

- ক) Mechanical খ) Laser গ) Electrical ঘ) Electro Magnetic

Answer: খ) Laser

Explanation: CDs use laser technology to read and write data from the optical disk surface.

6. Which mode of memory access is the fastest? --[সাধারণ পুলের আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

- ক) Reference খ) Pointer গ) Double pointer ঘ) DMA

Answer: ঘ) DMA

Website: <https://duranta.app/>

Explanation: Direct Memory Access allows hardware to access memory without CPU, making it the fastest.

7. Some programs exist for computers use to help it manage its tasks and devices, which are called [AME-Gen. Pull-2019]

- A. Software
- B. Application software
- C. System software
- D. Firmware

Answer: C

Explanation: System software is designed to manage hardware and provide a platform for running application software. It includes the operating system (like Windows, Linux), device drivers, and utility programs. Its job is to control and coordinate the usage of computer hardware and support the execution of application programs.

Network Security

General ICT / Mixed Topics

1. In Cryptography, RSA is... [সাধারণ পূলের আওতায় সহকারী প্রোগ্রামার ২২]

- ক) Symmetric key based
- খ) Block-chain based
- গ) Asymmetric key based
- ঘ) None

Answer: গ) Asymmetric key based

Explanation: RSA uses two keys (public and private), making it an asymmetric encryption algorithm.

Algorithms

5. Which of the following is not in connection with blockchain technology? [সাধারণ পূলের

আওতায় সহকারী রক্ষণাবেক্ষণ প্রকৌশলী ২২]

- ক) Centralized social network
- খ) Peer-to-Peer digital currency
- গ) Peer-to-peer social network
- ঘ) Distributed Ledger management

Answer: ক) Centralized social network

Explanation: Blockchain is decentralized. A centralized network does not relate to blockchain technology.

