Q. 1 – Q. 25 carry one mark each.

Q.1 In a compiler, keywords of a language are recognized during

(A) parsing of the program
(B) the code generation
(C) the lexical analysis of the program
(D) dataflow analysis

Q.2 A layer-4 firewall (a device that can look at all protocol headers up to the transport layer) **CANNOT**

(A) block entire HTTP traffic during 9:00PM and 5:00AM
(B) block all ICMP traffic
(C) stop incoming traffic from a specific IP address but allow outgoing traffic to the same IP address
(D) block TCP traffic from a specific user on a multi-user system during 9:00PM and 5:00AM

Q.3 If two fair coins are flipped and at least one of the outcomes is known to be a head, what is the probability that both outcomes are heads?

(A) 1/3 (B) 1/4 (C) 1/2 (D) 2/3

Q.4 Consider different activities related to email.

m1: Send an email from a mail client to a mail server
m2: Download an email from mailbox server to a mail client
m3: Checking email in a web browser

Which is the application level protocol used in each activity?

(A) m1: HTTP m2: SMTP m3: POP
(B) m1: SMTP m2: FTP m3: HTTP
(C) m1: SMTP m2: POP m3: HTTP
(D) m1: POP m2: SMTP m3: IMAP

HTTP: Used to transfer web pages over the internet.
SMTP: Used to send emails from a client to a server or between servers.
POP: Used to retrieve emails from a server to a client.
FTP: Used to transfer files between computers on a network.
IMAP: Used to access and manage emails on a server from multiple devices.

Q.5 A company needs to develop a strategy for software product development for which it has a choice of two programming languages L1 and L2. The number of lines of code (LOC) developed using L2 is estimated to be twice the LOC developed with L1. The product will have to be maintained for five years. Various parameters for the company are given in the table below.

Parameter	Language L1	Language L2
Man years needed for development	LOC/10000	LOC/10000
Development Cost per man year	₹ 10,00,000	₹ 7,50,000
Maintenance time	5 years	5 years
Cost of maintenance per year	₹ 1,00,000	₹ 50,000

Total cost of the project includes cost of development and maintenance. What is the LOC for L1 for which the cost of the project using L1 is equal to the cost of the project using L2?

(A) 4000 (B) 5000 (C) 4333 (D) 4667

Q.6 Let the time taken to switch between user and kernel modes of execution be t_1 while the time taken to switch between two processes be t_2. Which of the following is **TRUE**?

(A) $t_1 > t_2$
(B) $t_1 = t_2$
(C) $t_1 < t_2$
(D) nothing can be said about the relation between t_1 and t_2

Q.7 A company needs to develop digital signal processing software for one of its newest inventions. The software is expected to have 40000 lines of code. The company needs to determine the effort in person-months needed to develop this software using the basic COCOMO model. The multiplicative factor for this model is given as 2.8 for the software development on embedded systems, while the exponentiation factor is given as 1.20. What is the estimated effort in person -months?

(A) 234.25 (B) 932.50 (C) 287.80 (D) 122.40

Q.8 Which of the following pairs have **DIFFERENT** expressive power?

(A) Deterministic finite automata (DFA) and Non-deterministic finite automata (NFA)
(B) Deterministic push down automata (DPDA) and Non-deterministic push down automata (NPDA)
(C) Deterministic single-tape Turing machine and Non-deterministic single-tape Turing machine
(D) Single-tape Turing machine and multi-tape Turing machine

Q.9 HTML (HyperText Markup Language) has language elements which permit certain actions other than describing the structure of the web document. Which one of the following actions is **NOT** supported by pure HTML (without any server or client side scripting) pages?

(A) Embed web objects from different sites into the same page
(B) Refresh the page automatically after a specified interval
(C) Automatically redirect to another page upon download
(D) Display the client time as part of the page

Q.10 Which one of the following is **NOT** desired in a good Software Requirement Specifications (SRS) document?

(A) Functional Requirements (B) Non-Functional Requirements
(C) Goals of Implementation (D) Algorithms for Software Implementation

Q.11 A computer handles several interrupt sources of which the following are relevant for this question.

- Interrupt from CPU temperature sensor (raises interrupt if CPU temperature is too high)
- Interrupt from Mouse (raises interrupt if the mouse is moved or a button is pressed)
- Interrupt from Keyboard (raises interrupt when a key is pressed or released)
- Interrupt from Hard Disk (raises interrupt when a disk read is completed)

Which one of these will be handled at the **HIGHEST** priority?

(A) Interrupt from Hard Disk (B) Interrupt from Mouse
(C) Interrupt from Keyboard (D) Interrupt from CPU temperature sensor

Q.12 Consider a relational table with a single record for each registered student with the following attributes.

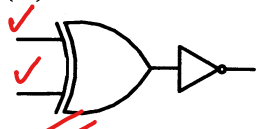
1. *Registration_Num*: Unique registration number of each registered student
2. *UID*: Unique identity number, unique at the national level for each citizen
3. *BankAccount_Num*: Unique account number at the bank. A student can have multiple accounts or joint accounts. This attribute stores the primary account number.
4. *Name*: Name of the student
5. *Hostel_Room*: Room number of the hostel

Which of the following options is **INCORRECT**?

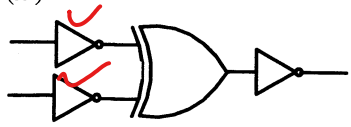
(A) *BankAccount_Num* is a candidate key
(B) *Registration_Num* can be a primary key
(C) *UID* is a candidate key if all students are from the same country
(D) If S is a superkey such that $S \cap UID$ is NULL then $S \cup UID$ is also a superkey

Q.13 Which one of the following circuits is **NOT** equivalent to a 2-input XNOR (exclusive NOR) gate?

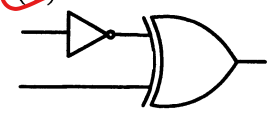
(A)



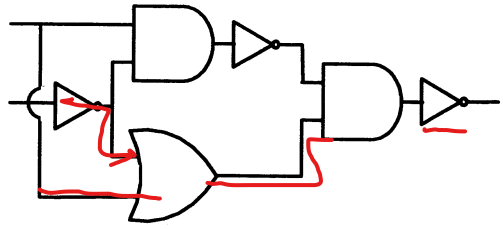
(B)



(C)



(D)



Q.14 The simplified SOP (Sum of Product) form of the Boolean expression $\left(P+\overline{Q}+\overline{R}\right).\left(P+\overline{Q}+R\right).\left(P+Q+\overline{R}\right)$ is

(A) $\left(\overline{P}.Q+\overline{R}\right)$
(B) $\left(P+\overline{Q}.\overline{R}\right)$
(C) $\left(\overline{P}.Q+R\right)$
(D) $\left(P.Q+R\right)$

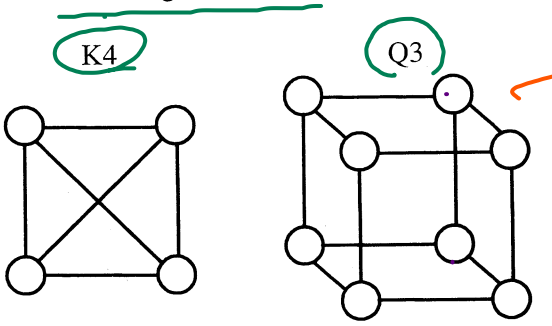
Q.15 The minimum number of D flip-flops needed to design a mod-258 counter is

(A) 9 (B) 8 (C) 512 (D) 258

Q.16 A thread is usually defined as a "light weight process" because an operating system (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the following is **TRUE**?

(A) On per-thread basis, the OS maintains *only* CPU register state
(B) The OS does not maintain a separate stack for each thread
(C) On per-thread basis, the OS does not maintain virtual memory state
(D) On per-thread basis, the OS maintains *only* scheduling and accounting information

Q.17 K4 and Q3 are graphs with the following structures.



Which one of the following statements is **TRUE** in relation to these graphs?

(A) K4 is planar while Q3 is not
(B) Both K4 and Q3 are planar
(C) Q3 is planar while K3 is not
(D) Neither K4 nor Q3 is planar

Q.18 If the difference between the expectation of the square of a random variable $\left(E\left[X^2\right]\right)$ and the square of the expectation of the random variable $\left(E\left[X\right]\right)^2$ is denoted by R, then

(A) $R=0$ (B) $R<0$ (C) $R\geq 0$ (D) $R>0$

Q.19 The lexical analysis for a modern computer language such as Java needs the power of which one of the following machine models in a necessary and sufficient sense?

(A) Finite state automata
(B) Deterministic pushdown automata
(C) Non-deterministic pushdown automata
(D) Turing machine

Q.20 Let the page fault service time be 10 ms in a computer with average memory access time being 20 ns. If one page fault is generated for every 10^6 memory accesses, what is the effective access time for the memory?

(A) 21 ns (B) 30 ns (C) 23 ns (D) 35 ns

Q.21 Consider a hypothetical processor with an instruction of type `LW R1, 20(R2)`, which during execution reads a 32-bit word from memory and stores it in a 32-bit register R1. The effective address of the memory location is obtained by the addition of a constant 20 and the contents of register R2. Which of the following best reflects the addressing mode implemented by this instruction for the operand in memory?

(A) Immediate Addressing
(B) Register Addressing
(C) Register Indirect Scaled Addressing
(D) Base Indexed Addressing

Q.22 What does the following fragment of C program print?

```
Char c[] = "GATE2011";
char *p  = c;
printf("%s", p + p[3] - p[1]);
```

(A) GATE2011 (B) E2011 (C) 2011 (D) 011