



ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ

PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Max. Marks: 90

Time: 90 Mins.

Entrance Test for Enrollment in Ph.D. Programme

Important Instructions

- Fill all the information in various columns, in capital letters, with blue/black ball point pen.
- Use of calculators is not allowed.
- All questions are compulsory. No negative marking for wrong answers.
- Each question has only one right answer.
- Questions attempted with two or more options/answers will not be evaluated.

1) Consider the following two languages:

$$L_1 = \{0^n 1^{2n} 0^n \mid n \geq 0\} \text{ and } L_2 = \{0^m 1^{m+n} 0^n \mid m, n \geq 0\}$$

Which of the following is true?

- A) L_1 is context-free. L_2 is context-free.
- B) L_1 is context-free, but not recursive. L_2 is not context-free.
- C) L_1 is recursive, but not context-free. L_2 is context-free.
- D) L_1 is context-free. L_2 is not context-free.
- 2) Consider the following grammar G_1 defined in abbreviated format: $S \rightarrow SSS \mid b$.
The 4 shortest strings in $L(G_1)$ are:
- A) b, bb, bbb, bbbb
- B) b, bbb, bbbbbb, bbbbbbbb
- C) b, bb, bbbb, bbbbbbb
- D) bbb, bbbbbbb, bbbbbbbbbbb, bbbbbbbbbbbbbbb
- 3) Which of the following is the most plausible series of phases for a modern compiler?
- A) scanning, parsing, intermediate code generation, semantic analysis, machine-independent code improvement, target code generation, machine-specific code improvement
- B) scanning, parsing, semantic analysis, intermediate code generation, machine-independent code improvement, target code generation, machine-specific code improvement
- C) scanning, parsing, semantic analysis, intermediate code generation, machine-independent code improvement, machine-specific code improvement, target code generation
- D) scanning, parsing, semantic analysis, machine-independent code improvement, intermediate code generation, target code generation, machine-specific code improvement
- 4) If r and s are regular expressions then which of the following identities is correct?
- A) $rs^* = rss^*$
- B) $(r*s^*) = (r + s)^*$
- C) $(r + s)^* = r^* + s^*$
- D) $(r*s^*)^* = (r + s)^*$
- 5) The data models defined by ANSI/SPARC architecture are
- A) Conceptual, physical and internal
- B) Conceptual, view and external
- C) Logical, physical and internal
- D) Logical, physical and view
- 6) The constraint that no key attribute (column) may be null is referred to as:

- A) Referential integrity
- B) Multi-valued dependency
- C) Entity integrity
- D) Functional dependency

7) Consider a database with the following schema. This database records information about chefs (including their name and their rating), and the dishes they prepare. For each dish, the database records its name and its popularity score.

```
Chef(cid, name, rating) /* cid is
a chef's unique identifier */
Dish(did, name, popularity) /* did
is a dish's unique identifier */
Prepares(cid, did) /* cid
references Chef.cid and did
references Dish.did */
```

What does the following SQL query does?

```
SELECT d.name
FROM Dish d, Prepares p
WHERE d.did=p.did
GROUP BY d.did, d.name
HAVING COUNT(p.cid)=1
```

- A) It finds, for each chef, the most popular dish that he or she prepares.
 - B) It lists the names of the dishes prepared by a chef having his/ her unique identifier = 1.
 - C) It lists the names of the dishes prepared by only one chef.
 - D) It finds the most popular dish prepared by a chef having his/ her unique identifier = 1.
- 8) For a violation of 2NF to occur in a table in 1NF, the following condition must exist:
- A) There must be some specific nontrivial multi-valued dependencies
 - B) There must be transitive dependencies
 - C) Part of a key determines non-key attribute

D) Part of a key does not determine a non-key attribute

9) One approach to handling fuzzy logic data might be to design computer using ternary (base-3) logic so that data could be stored as "true," "false," and "unknown". If each ternary logic element is called a FLIT (Fuzzy Logic Digit), how many FLITS are required to represent at least 256 different values?

- A) 4
- B) 5
- C) 6
- D) 7

10) An 8-bit byte with binary value 10100111 is to be encoded using an even-parity Hamming code. The number of check bits that are required and the binary value after encoding will be:

- A) 4 and 1010 0011 1110 respectively.
- B) 3 and 010 0011 1110 respectively.
- C) 2 and 11 0011 1110 respectively.
- D) 5 and 1010 0011 1110 respectively.

11) Simplified form of the Boolean expression

$xy + z(\bar{x} + y)$ is:

- A) $xy + \bar{z}(\bar{x} + \bar{y})$
- B) $xy + z(x + y)$
- C) $xy + zy$
- D) $xy + \bar{x}z$

12) Assume 16-bits are used to represent an integer. The representation of -168 in two's complement form is:

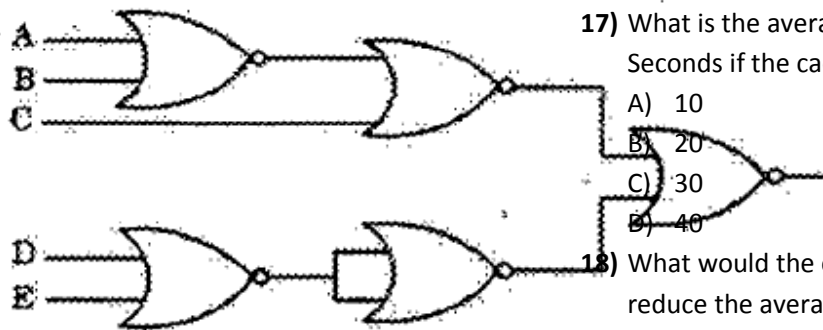
- A) $80A8_{16}$
- B) $80A9_{16}$
- C) $FF57_{16}$
- D) $FF58_{16}$

13) In computer science, big-endian computer systems store

- A) the MSB of data at the lowest storage address of data unit.

- B) the LSB of data at the lowest storage address of data unit.
- C) the MSB of data at the highest storage address of data unit.
- D) the LSB of data at the highest storage address of data unit.

14) The circuit shown in the following figure realizes the function:



- A) $(\overline{A+B+C})(\overline{DE})$
- B) $(\overline{A+B+C})(DE)$
- C) $(A+\overline{B+C})(\overline{DE})$
- D) $(A+B+\overline{C})(\overline{DE})$

15) If $N^2 = (7601)_g$ where N is a positive integer, then the value of N and g is:

- A) $(241)_5$ and 6 respectively.
- B) $(143)_6$ and 8 respectively.
- C) $(165)_7$ and 5 respectively.
- D) $(39)_{16}$ and 10 respectively.

16) Suppose a computer using direct mapped cache has 2^{20} words of main memory, and a cache of 32 blocks, where each cache block contains 16 words. What is the format of a memory address as seen by the cache, i.e., what are the sizes of the tag, block, and word fields?

- A) 11-bits, 5-bits and 4-bits respectively.

- B) 8-bits, 4-bits and 4-bits respectively.
- C) 10-bits, 4-bits and 5-bits respectively.
- D) 11-bits, 4-bits and 5-bits respectively.

Directions for next Two Questions:

The cache hit rate is the rate of the information that is needed in the cache. The average access time for main memory is 60 Nano Seconds and the average access time for cache memory is 10 Nano Seconds.

17) What is the average access time in Nano Seconds if the cache hit rate is 80%?

- A) 10
- B) 20
- C) 30
- D) 40

18) What would the cache hit rate have to be to reduce the average access time to 16 Nano Seconds?

- A) 82% or more
- B) 80% or more
- C) 84% or more
- D) 88% or more

19) Round robin scheduling is essentially the preemptive version of _____.

- A) FIFO
- B) Shortest Job First
- C) Shortest Remaining Time
- D) Longest Remaining Time

20) The process related to process control, file management, device management, information about system and communication that is requested by any higher level language can be performed by _____.

- A) Editors
- B) Compilers
- C) System Call
- D) Caching

21) Routine is not loaded until it is called. All routines are kept on disk in a relocatable

load format. The main program is loaded into memory & is executed. This type of loading is called _____.

- A) Static Loading
- B) Dynamic Loading
- C) Debug Loading
- D) Overlay Loading

22) The term 'Aging' in operating system refers to:

- A) keeping track of the time a page has been in memory for the purpose of LRU replacement
- B) Boosting up the priority of a process in multi-level queue with feedback
- C) Gradually increasing the priority of jobs that wait in the system for a long time to remedy indefinite blocking
- D) Letting jobs reside in memory for a certain amount of time so the number of pages required can be estimated accurately.

23) Suppose that there are 'n' processes in the ready queue to be scheduled on one processor. How many different possible schedules are there?

- A) n_{c_2} i.e. combination of n things taken 2 at a time
- B) n_{p_2} i.e. permutation of n things taken 2 at a time
- C) $n!$ i.e. factorial of n
- D) $n + 1$

24) If four values a, b, c and d satisfying $a < b < c < d$, are the execution times of the processes P, Q, R and S respectively, then the average turnaround time when shortest job first CPU scheduling algorithm is used, is given by:

- A) $(3a + 4b + c + d) / 4$
- B) $(4a + 3b + 2c + d) / 4$
- C) $(a + 2b + 3c + 4d) / 4$

D) $(3a + 2b + c + d) / 4$

25) Match the type of CPU schedule with its purpose.

Type of CPU Schedule

Purpose of CPU Schedule

(I) Long Term (a)

Brings the process from read state to running state

(II) Short Term

(b) Deals with swapping

(III) Mid Term (c)

Brings the process from new state to ready state

A) (I) - (c), (II) - (a), (III) - (b)

B) (I) - (b), (II) - (c), (III) - (a)

C) (I) - (c), (II) - (b), (III) - (a)

D) (I) - (a), (II) - (c), (III) - (b)

26) What is a micro benchmark?

- A) a real program, whose executions on various systems are evaluated to make comparisons between systems
- B) a small program or function that measures the time required for a system to perform a specific operating system primitive or system operation
- C) a program that is designed to evaluate the performance of a specific component or subsystem, such as the file system
- D) a measure of "raw horsepower," used for making quick comparisons between hardware

27) What was/were the original motivation(s) behind the CISC processor-design philosophy?

- A) CISC instruction sets could be implemented with simple hardware, decreasing hardware-design cost.

- B) Programs written for CISC processors executed quickly because they took full advantage of pipelines.
- C) CISC instruction sets made it easy to code in assembly language, and programs consumed less memory.
- D) Complex instructions were more-frequently used than simple instructions.

- 28) By default, Linux supports _____.
- A) symmetric multiprocessing (SMP)
 - B) cache-only memory access (COMA)
 - C) programs written for operating systems including Windows and MacOS
 - D) all of the above

- 29) Linux is best described as a(n) _____ kernel.
- A) monolithic
 - B) layered
 - C) micro
 - D) export

- 30) The function F is recursively defined as follows:

$$F(x) = \begin{cases} \frac{x}{2} & \text{if } x \text{ is even} \\ F(F(3x+1)) & \text{if } x \text{ is odd} \end{cases}$$

If $x = 2^k + 1, k > 3$, then $F(x) =$

- A) $3 \times 2^{k-1} + 1$
- B) $3 \times 2^{k-1} + 7$
- C) $3 \times 2^{k-2} + 1$
- D) $3 \times 2^{k-3} + 7$

- 31) What does the following C-code output?

```
int n = 0;
while (1) {
    n++;
    if (n == 100) {
        break;
    }
} // end while
```

```
if (n < 100) {
    n = 3 * n + 25;
} else if (n > 90) {
    n = 2 * n - 50;
} else {
    n = n % 10;
}
printf("N = %d", n);
```

- A) N = 1
- B) N = 0
- C) N = 100
- D) N = 150

- 32) Find the exact solution of the following recurrence. (Assume $n = 2^k$)

$$T(1) = 1,$$

$$T(n) = 4T(n/2) + n, n > 1.$$

- A) $2n^2 + n$
- B) $2n^2 - n$
- C) $n^2 - 2n$
- D) $n^2 - n$

- 33) Study the following C-program:

```
/* pre-condition : x>=0 */
void link(int x)
{
    printf("%d", x % 10);

    if((x / 10) != 0)
    {
        link(x / 10);
    }
    printf("%d", x % 10);
}
```

Which of the following is printed as a result of the call $link(1234)$?

- A) 1441
- B) 4321
- C) 12344321
- D) 43211234

- 34) 802.11 is the standard for _____ developed by the Institute of Electrical and Electronics Engineers (IEEE).

- A) Wireless LANs
 - B) Ethernet
 - C) Bluetooth
 - D) Broadband Wireless
- 35)** If there are five routers and six networks in an Intranet using link state routing, how many routing tables are there?
- A) 1
 - B) 5
 - C) 6
 - D) 11
- 36)** In _____, each packet of a message follows the same path from sender to receiver.
- A) circuit switching
 - B) message switching
 - C) the virtual approach to packet switching
 - D) the datagram approach to packet switching
- 37)** The supplementary protocol that allows the use of non-ASCII characters in an e-mail is called the _____ protocol.
- A) MIME
 - B) POP
 - C) POP2
 - D) TELNET
- 38)** The official network management protocol in TCP/IP protocol suite is called _____.
- A) SNMP
 - B) SNMP
 - C) SMTP
 - D) DNS
- 39)** In decimal notation, the first byte of a class-E IP address should be between _____ and _____.
- A) 0; 127
 - B) 192; 223
 - C) 224; 239
 - D) 240; 255
- 40)** Bit stuffing refers to
- A) inserting a '0' in user data stream to differentiate it with a flag
 - B) inserting a '0' in flag stream to avoid ambiguity
 - C) appending a nibble to the flag sequence
 - D) appending a nibble to the user data stream
- 41)** Which protocol translates private (non-routable) IP addresses into public (routable) IP addresses?
- A) NAT
 - B) DHCP
 - C) DNS
 - D) ICMP
- 42)** The Internet Protocol (IPv4) is an example of a:
- A) connection-less network layer protocol
 - B) connection-oriented network layer protocol
 - C) connection-less transport layer protocol
 - D) connection-oriented transport layer protocol
- 43)** The transmission time required for sending a 512-Byte packet using a 56 kbps modem is:
- A) about 7 milliseconds
 - B) about 40 milliseconds
 - C) about 70 milliseconds
 - D) about 90 milliseconds
- 44)** Which of the following is not a utility in Windows OS to ensure backup and adequate performance of an internal hard disk?
- A) Backup
 - B) Disk Cleanup
 - C) Disk Defragmenter
 - D) Internet Explorer
- 45)** "RAID (redundant array of independent disks, originally redundant array of inexpensive disk) is a storage technology that combines multiple disk drive components into a logical unit". Which of

the following statements is incorrect about RAID technology?

- A) RAID-5 is preferred to RAID-1 when the database requires frequent data modifications
- B) RAID-1 requires more storage than RAID-5
- C) RAID-1 requires less write time than RAID-5
- D) RAID-5 does not duplicate the data themselves

46) "Software reliability is the probability of failure free operation of a program for a specified time in a specified environment". If failure intensity of a software is 0.005 failures per hour during 100 hours of operation of a software, then software reliability can be expressed as:

- A) 0.90
- B) 0.92
- C) 0.95
- D) 0.98

47) "In Halstead theory of software science, the program volume V of a software product is measured in bits and these bits are actual size of the program if a uniform binary encoding scheme for vocabulary is used".

If $V = N \log_2^n$, then

- A) N is vocabulary of the program and n is program length.
- B) N is program length and n is the number of loops in a program.
- C) N is program length and n is vocabulary of the program.
- D) N is vocabulary of the program and n is the number of functions in a program.

48) Alpha and beta testing techniques are related to:

- A) System Testing

- B) Unit Testing
- C) Acceptance Testing
- D) Integration Testing

49) Consider the following statements I, II and III:

- I. Checking the software product with respect to the constraints of the project
- II. Checking the software product with respect to the customer's expectations
- III. Checking the software product with respect to the specifications

Which of the following is true?

- A) Software verification implies statement - II whereas software validation implies statement - I
- B) Software verification implies statement - III whereas software validation implies statement - II
- C) Software verification implies statement - III whereas software validation implies statement - I
- D) Software verification implies statement - I whereas software validation implies statement - II

50) The process of testing a program with full knowledge of how the code is written is known as:

- A) Regression testing
- B) Black box testing
- C) White box testing
- D) Test suit harnessing

51) Select the item that best defines "fetch and execute cycle".

- A) in the CPU, get an instruction from memory, decode it, get data from memory, compute and return the result, then do it all again
- B) the process by which a "for loop" computes on an array

- C) the process of getting a program from a source file, compiling it to byte-code, then running the virtual machine to execute it
- D) the process of getting command line arguments into variables, then passing them to a method or function call
- 52)** For the functions $f, g, h,$ and $k,$ if $f(n) = O(g(n))$ and $h(n) = \omega(k(n)),$ then which of the following is true?
- A) $g(n) = \Omega(f(n))$ and $k(n) = o(h(n))$
- B) $g(n) = o(f(n))$ and $k(n) = \Omega(h(n))$
- C) $g(n) = O(f(n))$ and $k(n) = \omega(h(n))$
- D) $g(n) = \omega(f(n))$ and $k(n) = O(h(n))$
- 53)** Which of the following best defines "divide and conquer" technique?
- A) a method used in compilers to implement mathematical division for double length floating point numbers
- B) an approach to program writing that requires comments and code to be in the same source file
- C) a programming technique in which the code for a function (method) involves calling the function itself
- D) a problem solving strategy where the problem is too large to solve directly so it is broken into smaller solvable problems
- 54)** A binary search tree is generated by inserting in order the following 12 integers:
50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24
- The number of nodes in the left and right sub-tree of the root respectively is:
- A) 4 and 7
- B) 7 and 4
- C) 8 and 3
- D) 3 and 8
- 55)** The postfix equivalent of the prefix expression $* + p q - r s$ is:
- A) $p q + r s * -$
- B) $p q + - r s *$
- C) $p q r s + - *$
- D) $p q + r s - *$
- 56)** Given the hash function $h(k) = k \bmod 3$ in which collision resolution is done by chaining. The number of collisions and the length of the longest chain to store the sequence of keys 15, 11, 34, 10, 98, 51, 37, 14, 16, 47, 49, are respectively given by:
- A) 2 and 5
- B) 8 and 4
- C) 9 and 4
- D) 8 and 5
- 57)** A sorting technique that guarantees that records with the same primary key occur in the same order in the sorted list as in the original unsorted list, is said to be:
- A) Linear
- B) External
- C) Stable
- D) Consistent
- 58)** In a full binary tree if the number of nodes is 31 then the height of the tree is:
- A) 2
- B) 3
- C) 4
- D) 5
- 59)** Which of the following statements is false?
- A) An optimal search strategy finds the solution as quickly as possible.
- B) A complete search strategy is guaranteed to find a solution if there is one.

- C) A low time complexity search strategy investigates as few states as possible.
 D) A low space complexity search strategy has to remember as little as possible.
- 60)** Which of these is NOT an exhaustive search method?
 A) Breadth first search
 B) Depth first search
 C) Hill climbing
 D) Uniform cost
- 61)** The solution to the Towers of Hanoi problem with n disks requires
 A) 2^n moves
 B) $2^n - 1$ moves
 C) $2^n - 2$ moves
 D) 2^{n+1} moves
- 62)** Let S be an NP-Complete problem. Q and R are two other problems not known to be in NP. Q is polynomial-time reducible to S and S is polynomial-time reducible to R . Which of the following statement is true?
 A) R is NP-Complete
 B) R is NP-Hard
 C) Q is NP-Complete
 D) Q is NP-Hard.

- 63)** What is the Big O notation for the order of growth in time of the function `mystery()`?

```
public int mystery(int num){
    if (num == 0 || num == 1)
        return 1;
    return mystery(num-1) +
        mystery(num-2);
}
```

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

- 64)** Multiprogramming permits the UNIX Operating System to overlap the execution of _____ processes with that of _____ processes.
 A) Background, Foreground
 B) Parent, Child
 C) I/O Bound, CPU Bound
 D) Critical, Non-critical

- 65)** It is known that Unix OS has an inode-based file system. The file-system has 512 byte blocks. Each inode has 10 direct, 1 single indirect, 1 double indirect block, and 1 triple indirect block pointer. Block pointers are 4 bytes each. Assume the inode and any block free list is always in memory. Blocks are not cached.

What is the maximum file size that can be stored before the double indirect pointer needed?

- A) 5K
 B) 25K
 C) 69K
 D) 8261K

The following information pertains to next three questions:

Consider a disk drive with the following parameters: seek time = 5 ms, rotational latency = 5 ms, and a transfer rate (after the seek and rotational latency have occurred) of 10 MB/s. Recall that 1 ms = 10^{-3} seconds, 1 MB = 10^6 bytes (To ease the arithmetic), and 1 MB/s = 1 MB per second.

- 66)** Consider two disks with the above parameters, one with a block size of 10,000 bytes and the other with a block size of 20,000 bytes. What is the total time to read one block for each of these disks?

- A) 11ms & 12 ms
 B) 12 ms & 13 ms
 C) 13 ms & 14 ms
 D) 12 ms for both
- 67)** What *overall transfer rate* (in MB/s) is achieved for each of two disks?
 A) 10/11 MB/seconds and 5/3 MB/seconds
 B) 11/12 MB/seconds and 5/4 MB/seconds
 C) 10/13 MB/seconds and 8/3 MB/seconds
 D) 13/16 MB/seconds and 7/3 MB/seconds
- 68)** Note that rotating a disk *n* times faster both decreases rotational latency and increases transfer rate each by a factor of *n*. What *n* is needed for the overall transfer rate of the small block size disk to match that of the large block size disk?
 A) 6
 B) 7
 C) 8
 D) 9
- 69)** Which of the following represent the largest and smallest positive normalized numbers that can be represented as an IEEE single-precision floating point number? Recall that single-precision IEEE numbers have a sign bit, 8 bits representing an excess-127 biased exponent, and 23 fraction bits (a leading 1 followed by a binary point is implied). Also recall that when exponent bits are all zeros or all ones, they do not have the usual meaning.
 A) $2^{127} \times (2 - 2^{-23})$ and 2^{-126}
 B) $2^{127} \times (1 - 2^{-127})$ and 2^{-126}
 C) 2^{128} and $2^{-127} \times (2 - 2^{-23})$
 D) $2^{127} \times (1 - 2^{-23})$ and 2^{-126}
- 70)** Which of the following statements correctly returns the memory from the dynamic array pointed to by *p1* to the heap?
 A) `delete [] p1;`
 B) `delete p1[];`
 C) `delete *p1;`
 D) `delete p1;`
- 71)** Which file open mode would be used to write data only to the end of an existing file in C++?
 A) `ios::app`
 B) `ios::in`
 C) `ios::out`
 D) `ios::trunk`
- 72)** To prevent modification of array values in a function in C++
 A) the array must be declared *static* in the function
 B) the array parameter can be preceded by the *const* qualifier
 C) a copy of the array must be made inside the function
 D) the array must be passed using call-by-reference
- 73)** SCSI stands for
 A) Standard Computer Systems Interface
 B) Small Computer Standards Interface
 C) Super Computer Systems Interface
 D) Small Computer Systems Interface
- 74)** Given below are some statements associated with the Width parameter of processors. Identify the correct statement among them.
 A) The width parameters of processor refers to the data bus, internal registers & the address bus.
 B) The width of the address bus does not have an implication on the maximum addressable main memory of a computer.

- C) The width of the internal registers has no implication on the size of the data chunk processed by the processor.
- D) The length of an instruction in a processor with a 64-bit internal register has to always be 32-bits.
- 75)** Assemblers usually make two passes over the source code. In the first pass, the assembler
- A) Translates the program source into machine code
- B) Writes the object file
- C) Builds the symbol table
- D) Builds the op-code table
- 76)** Which input method is used mainly by banks for processing cheques?
- A) OMR
- B) Bard code reader
- C) Light Pen
- D) MICR
- 77)** The _____ is the number of times per second the electron beam scans the monitor and recharges the illumination of each pixel.
- A) Resolution
- B) Sharpness
- C) Refresh rate
- D) Dot pitch
- 78)** How much frame buffer is needed for a 1280 by 1024 screen with 24-bit color?
- A) 2.75 megabytes
- B) 3.75 megabytes
- C) 4.75 megabytes
- D) 3.25 megabytes
- 79)** The Painter's algorithm sorts polygons by depth and then paints (scan-converts) each polygon onto the screen starting
- A) the most distant polygon
- B) the most nearest polygon
- C) the middle polygon
- D) large polygons followed by small polygons
- 80)** An advanced color monitor has a 1,250 x 1,250 pixel display, at 72 dpi. It can display 24 bits per pixel. The refresh rate is 60 Hz. What is the approximate rate at which the 24-bit wide memory must be accessed in bytes/second?
- A) 201.25 MB/seconds
- B) 301.25 MB/seconds
- C) 151.25 MB/seconds
- D) 281.25 MB/seconds
- 81)** The number of integers in $S = \{1, 2, 3, 4, 5, \dots, 999, 1000\}$ that are divisible by 3 or 5, is:
- A) 599
- B) 467
- C) 333
- D) 66
- 82)** The number of edges in a complete graph having 12 nodes is:
- A) 12
- B) 144
- C) 66
- D) 60
- 83)** Which of these propositions is not logically equivalent to the other three?
- A) $(p \vee r) \rightarrow q$
- B) $(p \rightarrow q) \wedge (r \rightarrow q)$
- C) $(p \wedge r) \rightarrow q$
- D) $\neg q \rightarrow (\neg p \wedge \neg r)$
- 84)** Suppose $A \subseteq B \subseteq C$. If $S = C - A$ and $T = C - B$, then which of the following best describes the relationship between S and T?
- A) $S \subseteq T$
- B) $T \subseteq S$
- C) $S = T$

- D) It cannot be determined from the information given.
- 85)** If $f: A \rightarrow B$ and $g: B \rightarrow C$ are functions, which of the following is not necessarily true?
- A) If $g \circ f$ is one-to-one, then f is one-to-one.
- B) If $g \circ f$ is onto, then g is onto.
- C) If $g \circ f$ is one-to-one, then g is one-to-one.
- D) $g \circ f \subseteq A \times C$
- 86)** The probability of occurrence of an event A is 0.7, the probability of non-occurrence of an event B is 0.45 and the probability of at least one of A and B not occurring is 0.6. The probability that at least one of A and B occurs is:
- A) 0.40
- B) 1
- C) 0.60
- D) 0.85
- 87)** The fork() UNIX system call:
- A) Runs a new program in a child process.
- B) Provides an exact copy of the current process's address space to an existing child process.
- C) Creates a new child process and gives it an exact copy of the current process's address space.
- D) Creates a new child thread and gives it an exact copy of the current process's address space.
- 88)** A difference between system calls and function calls is that:
- A) Only function calls preserve the stack frame; system calls do not.
- B) Function calls can be called from a signal handler but system calls cannot.
- C) System calls require a change of privilege level but function calls do not.
- D) System calls can pass arguments on the stack; function calls cannot.
- 89)** What are the two main types of intrusion detection systems?
- A) Signature-based and event-based
- B) Network-based and host-based
- C) Active and reactive
- D) Intelligent and passive
- 90)** To make a browser to show the line "Simple Program" at the top bar on the browser frame, which of the following HTML tag pairs will be used?
- A) `< title > < /title >`
- B) `< br > < /br >`
- C) `< table > < /table >`
- D) `< head > < /head >`