Q.1) Max Marks: 1

Which of the following is correct for the values of a and b in the given relation $(2a6)_b$ * $(57)_b$ = $(13706)_c$?

A a = 6, b = 12

B a = 9, b = 12 Correct Option

Solution: (B)

Solution:

The conditions are: b > 7 and b > a

On substituting values of option (i) we will get:

=> $(266)_{12}$ * $(57)_{12}$

=> $(366)_{10}$ * $(67)_{10}$ = $(24522)_{10}$

=> $(24522)_{10}$ = $(12236)_{12}$

Since the final outputs are not the same, therefore, the values of a and b are not correct.

For the option (ii) we will get:

=> $(296)_{12}$ * $(57)_{12}$

=> $(402)_{10}$ * $(67)_{10}$ = $(26934)_{10}$

=> $(26934)_{10}$ = $(13706)_{12}$

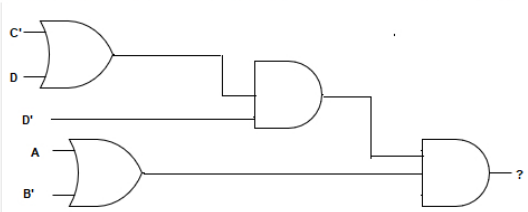
Hence, this option is correct.

C a = 12, b = 9

D None of the above

Q.2) Max Marks: 1

Which of the following is correct about function represented by the below-given circuit?

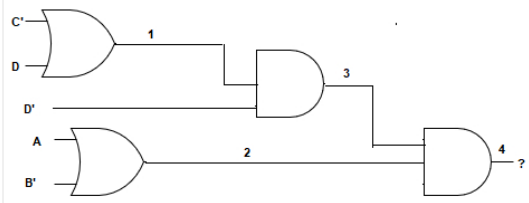


A (C'D')(A + B') Correct Option

Solution: (A)

Solution:

The expression at each step could be given as:



Expression at 1 will be: C' + D

Expression at 2 will be: A + B'

Expression at 3 will be: (C' + D) . D' => (C'D' + DD') => C'D'

Expression at 4 will be: C'D' (A + B')

B (C' + D') (A' + B')

C (C'D) (A + B')

D None of the above

Q.3) Max Marks: 1

Statement 1: Pretty good privacy (PGP) are used for encryption.
Statement 2: SHA-1 is used for creating a message digest.
Statement 3: In a public key cryptography sender's encrypt with its own public key.

A Only Statement 1 and Statement 3 are correct.

B Only Statement 2 and Statement 3 are correct.

C Only Statement 1 and Statement 2 are correct. Correct Option

Solution: (C)
Explanation:
Pretty Good Privacy (PGP) is an encryption program that provides cryptographic privacy and authentication for data communication
SHA (Secure Hash algorithm) is a hashing algorithm which produces 160-bit message digest as the output.
In the public-key cryptography(RSA) sender, encrypt's with receiver public key in the receiver decrypts with its own private key.

D All are correct.

Q.4) Max Marks: 1

Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources.
S1: System is deadlock free
S2: System is not deadlock free
Which of the following is correct?

A S1 is false

B S2 is true

C Both are false

D None of the above Correct Option

Solution: (D)
Explanation:
This system is deadlock-free. That is S1 is True.
Proof by contradiction:
Suppose the system is deadlocked. This implies that each process is holding one resource and is waiting for one more. Since there are three processes and four resources, one process must be able to obtain two resources. This process requires no more resources and, therefore it will return its resources when done.

Q.5) Max Marks: 1

What will be the efficiency of the channel in CSMA/CD when bandwidth is 40 Mbps. The speed of the signal is 2000K m/s. The frame size is 400 bits and the length of the cable 100 m.

Correct Answer

Solution: (3.03 %)

Explanation:

Tp= length/speed = 100 / 2000 x 10 ^3 m /s = 50 mu sec
Tt= Data size / BW = 400 / 40 x 10 ^6 = 10 mu sec
a= Tp / Tt = 50 / 10 = 5

Efficiency = 1 / (1 + 6.4 a) x 100 %
= 3.03%

Q.6) Max Marks: 1

Given m frames, p references, n distinct page numbers
S1 : The lower bound on the number of page faults is m
S2 : The upper bound on the number of page faults is p
Which of the following option is correct?

A S1 is True

B S2 is False

C Both S1 and S2 are False

D None of the above Correct Option

Solution: (D)
Explanation:
The lower bound on the number of page faults:
n -- These are compulsory misses. This could occur if page replacement is perfect, or there is more memory than needed (m > n)

The upper bound on the number of page faults:
p -- We could potentially miss on every page. This could occur if there is very little memory (m = 1) or if page replacement is particularly bad.
S1 is False & S2 is True. Therefore, option D is correct.

Q.7) Max Marks: 1

Which of the following is an option is the correct representation for the minterms of the following expression?
Boolean Expression: ABD + A'CD' +AB

A $M_1 + M_3 + M_7 + M_{10} + M_{11} + M_4$

B $M_2 + M_6 + M_{12} + M_1 + M_{13} + M_{14}$

C $M_2 + M_6 + M_{12} + M_{13} + M_{14}$

D $M_2 + M_6 + M_{12} + M_{15} + M_{13} + M_{14}$ Correct Option

Solution: (D)

Solution:

Given a boolean expression, there are 4 variables A, B, C and D. In first term variable C is missing, in second term variable B is missing which in term three, variable C and d both are missing.

From first term: ABD
=> ABD(C + C')
=> ABCD + ABC'D => M_{15} + M_{13}
From second term: A'CD'
=> A'CD'(B + B')
=> A'BCD' + A'B'CD' => M_6 + M_2
From third term: AB
=> AB(C + C')(D + D')
=> ABCD + ABCD' + ABC'D + ABC'D' => M_{15} + M_{14} + M_{13} + M_{12}

Hence, the final minterms will be => ABCD + ABC'D + ABCD' + ABC'D' + A'BCD' + A'B'CD' => M_{15} + M_{14} + M_{13} + M_{12} + M_6 + M_2

Q.8) Max Marks: 1

The address of the network is 169.165.0.0. If the subnet bits are 4 in the network then calculate the 12th host address of the third subnet.

A **169.165.48.11**

B **169.165.48.12** Correct Option

Solution: (B)
Explanation:

Net id: 169.165.0.0
This address belongs to class B.
Net bits = 16 , Subnet bits = 4. host bits= 12
Third subnet = 0011 = 3
Twelevth host = 000000001100
169.165. 0011 0000.00001100
Net bits Subnet bits host bits
169.165.48.12 s the required address.

C **169.165.32.12**

D **169.165.32.11**

Q.9) Max Marks: 1

Column A	Column B
1. DNS	(i). UDP
2. SMTP	(ii). TCP
3. DHCP	
4. FTP	

A **1- (ii) , 2- (ii), 3- (i), 4- (ii)**

B **1-(i), 2- (ii), 3(i), 4- (ii)** Correct Option

Solution: (B)

Explanation:
DNS uses UDP as the transport layer protocol. DNS requests are generally very small and fit well within UDP segments.
SMTP uses TCP as a transport layer protocol.
The DHCP employs a connectionless service model using the user datagram protocol(UDP).
FTP uses TCP as a transport layer protocol on port number 20 and 21.

C 1-(i), 2- (ii), 3(ii), 4-(i)

D 1-(i), 2- (i), 3(i), 4- (ii)

Q.10) Max Marks: 1

We consider a program which has the two segments shown below consisting of instructions in segment 0, and read/write data in segment 1. Segment 0 has read/execute protection (only read/execute privilege), and segment 1 has read/write protection(only read/write privilege). The memory system is a demand-paged virtual memory system with virtual addresses that have a 4-bit page number, and an 10-bit offset. The page tables and protection are as follows (all numbers in the table are in decimal):

Segment 0		Segment 1	
Read/Execute		Read/Write	
Virtual Page #	Page frame #	Virtual Page #	Page frame #
0	2	0	On Disk
1	On Disk	1	14
2	11	2	9
3	5	3	6
4	On Disk	4	On Disk
5	On Disk	5	13
6	4	6	8
7	3	7	12

Given the following three cases, which of the following option is correct?
(a) Fetch from segment 1, page 1, offset 3
(b) Store into segment 0, page 0, offset 16
(c) Fetch from segment 1, page 4, offset 28

A (a) and (b) are valid translations

B (b) is a page fault

C (c) is a protection fault

D None of the above Correct Option

Solution: (D)

Explanation:

	Address	Fault ?
(a)	(14,3)	No
(b)	NA	Protection fault: Write to read/execute segment
(c)	NA	Page fault

Q.11) Max Marks: 1

Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that the I/O-bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also assume that the context switching overhead is 0.1millisecond and that all processes are long-running tasks.
The CPU utilization for a round-robin scheduler when the time quantum is 10 milliseconds is _____ % (Upto a single decimal place)

Correct Answer

Solution: (94.8)
Explanation:
The time quantum is 10 milliseconds:
The I/O-bound tasks incur a context switch after using up only 1 millisecond of the time quantum. The time required to cycle through all the processes is therefore 10*1.1 + 10.1 (as each I/O-bound task executes for 1millisecond and then incur the context switch task, whereas the CPU-bound task executes for 10 milliseconds before incurring a context switch).
The CPU utilization is therefore 20/21.1 * 100 = 94.8%.

Q.12) Max Marks: 1

Which of the following is the correct representation of decimal number 9356 in 2421 code?

A 1111 1001 0101 0110

B 1111 0011 0101 1100 Correct Option

Solution: (B)

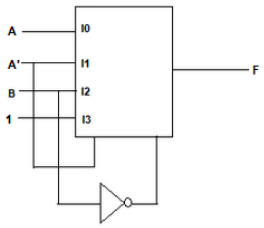
Solution:
In 2421, the number will be represented as:
2421 2421 2421 2421
1111 0011 0101 1100
| || |
9 35 6

C **1111 0011 0101 0110**

D **1111 1001 0101 1100**

Q.13) Max Marks: 1

Which of the following is correct about the minterms presents in the canonical sum of product form of function F shown in the combinational circuit given below?



A F(A, B) = Σ(0, 1, 2, 3, 4, 5, 6)

B F(A, B) = Σ(0, 1, 2, 3, 5, 6, 7)

C F(A, B) = Σ(0, 1, 2, 3, 6, 7) Correct Option

Solution: (C)

Solution:
Here, S1 = A' and S0 = B'
Based on the given MUX circuit along with the inputs, the expression for F will be given as:
=> F = S1'S0' . I0 + S1'S0. I1 + S1S0' . I2 + S1S0 . I3
=> AB.A + AB' . A' + A'B . B + A'B' . 1
=> AB + A'B + A'B'
On expanding it we will get:
=> ABC (M_7) + ABC' (M_6) + A'BC (M_3) + A'BC' (M_2) + A'B'C (M_1) + A'B'C' (M_0)

D F(A, B) = Σ(2, 3, 6, 7)

Q.14) Max Marks: 1

The broadcast address of some subnet of class A is 65.223.255.255
What could be the possible subnet mask?

A **255.224.0.0**

B **255.240.0.0**

C **255.248.0.0**

D **All of these** Correct Option

Solution: (D)
Explanation:
In Class A net bits = 8
In the broadcast address all host bits are 1.
223.255.255 = 110 11111.11111111.11111111
Here subnet bits should be 3 or more than 3 because [if we take a subnet bits less than 3 then it won't be a valid broadcast address]
For subnet bit 3 + 8 net bits = 11 mask no = 255.224.0.0
For subnet bits 4 + 8 net bits = 12 mask no = 255.240.0.0
For subnet bits 5 + 8 net bits = 13 mask no = 255.248.0.0

Q.15) Max Marks: 1

What is the issue with the following version of Dekker's Algorithm:

```
CSEnter(int i)
{
        inside[i] = true;
        while(inside[j])
        {
                inside[i] = false;
```

```
                while(turn == j) continue;
                inside[i] = true;
        }
}

CSExit(int i)
{
        turn = j;
        inside[i] = false;
}
```

A Deadlock is guaranteed

B Possibility of starvation — Correct Option

Solution: (B)
Explanation:
There is a possibility of starvation here.
Suppose process j is in critical section and
process i is busy waiting at the inner while loop. Now when process j exits the critical
section it sets turn = i, but it immediately tried to access the critical section and so sets
inside[j] = true. Right before process j executes "while (inside[i])", scheduler schedules
process i. Now process i exits from the inner while loop as turn = = i now, but it finds
inside[j] to be true so continue the outer while loop. Then after it executes
"inside[i]=false", the scheduler schedules process j and it finds the condition at outer
while loop to be false and enters the critical section. As a result, process i busy waits at
outer while loop. These steps can repeat arbitrary number of times and that starves
process i and it may never enter the critical section.
In the original algorithm, there is an extra checking "if (turn==j)" which ensures that this starvation never happens.

C Starvation never happen

D None of the above

Q.16) Max Marks: 2

Suppose a floppy disk has 40 cylinders. When storing a file on the floppy disk, the operating system (probably the floppy device driver) often attempts to put the blocks of the file in cylinders that are close to one another (if this can be accomplished). Assume that if the operating system does not attempt to cluster related blocks, two blocks that are logically consecutive are stored about 13 cylinders apart, on average.
However, if the operating system makes an attempt to cluster related blocks, the mean inter-block distance can be reduced to 2 cylinders. How long does it take to read 100 block file in each case, if a seek takes 6 milli-seconds per cylinder moved, the rotational latency is 20 milli-seconds on average, and the transfer time is 15 milli-seconds per block for 13 and 2 cylinders respectively?

A 12.1 seconds and 5.4 seconds

B 11.3 seconds and 4.7 seconds — Correct Option

Solution: (B)
Explanation:
Total time = seek time + rotational time + transfer time
In the first case: 13*6*100 ms + 20*100 ms + 15*100 ms = 11300 milliseconds = 11.3 seconds
In the second case: 2*6*100 ms + 20*100 ms + 15*100 ms = 4700 milliseconds = 4.7 seconds

C 15.5 seconds and 6.8 seconds

D None of the above

Q.17) Max Marks: 2

The maximum transfer unit of the network is 800 B and the packet size is 4000 bytes included the header of 20 B. Which of the following option is true for the fourth fragment?

A DF = 0 , MF=0 , offset= 290

B DF = 0 , MF=1 , offset= 290

C DF = 0 , MF=1 , offset= 291 — Correct Option

Solution: (C)
Explanation:
Data packet size = 4000 - 20 B = 3980B
3980 / 780 = 4.9 = 5.1 = 6 fragments
First fragment= 776[we want this divisible by 8] + 20 B = 796 B [FO: 0 - 96]
Second fragment = 776 +20 = 796 B [97 -193]
Third fragment = 776 + 20 = 796 B [194 -290]
Fourth fragment = 776 + 20 = 796 B [291 - 387]
DF = 0 [If it is a fragment]
MF= 1 [Intermediate fragment]

D DF = 1 , MF=0 , offset= 291

Q.18) Max Marks: 2

A computer system has a page size of 1,024 bytes and maintains the page table for each process in main memory. The overhead required for doing a lookup in the page table is 500 ns. To reduce this overhead, the computer has a TLB that caches 32 virtual pages to physical frame mappings. A TLB lookup requires 100ns. The TLB hit-rate that is required to ensure an average virtual address translation time of 200ns is ____(upto 1 decimal place)

Correct Answer

Solution: (0.8)

Explanation:

Let TLB hit rate = x

So in case of TLB hit , only TLB will be accessed for address translation..In case of a miss , assuming one level of paging , both TLB and page table will be accessed for address translation..

Hence effective address translation time = Time taken in hit + Time taken in case of miss

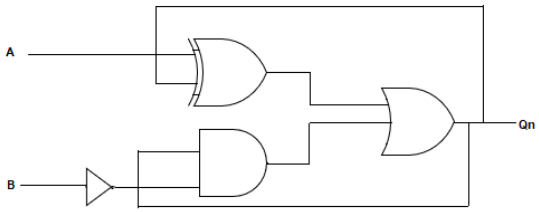
==> x(100) + (1-x)600 = 200

==> 600 - 500x = 200

==> x = 0.8

Hence, required hit ratio of TLB = 0.8

Q.19) Max Marks: 2



The total number of minimal expressions possible for the above given sequential circuit are _____

Correct Answer

Solution: (2)

Solution: 2

For the given sequential circuit the equation for Q_n will be:
$Q_n = A \oplus Q + B'Q = A'Q + AQ' + B'Q$
The function table will be:

A	B	Q_n
0	0	Q
0	1	Q
1	0	1
1	1	Q'

Based on this, we can make the characteristic table:

A	B	Q	Q_n
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

For function Q_n the k-map will be:

A\BQ	00	01	11	10
0	0	1	1	0
1	1	1	0	1

The essential prime implicants are: AQ' and A'Q
The other prime implicants are: AB' and B'Q
Therefore, the minimal expressions possible are:
1) AQ' + A'Q + AB'
2) AQ' + A'Q + B'Q

Q.20) Max Marks: 2

Given the following piece of code:

```
main()
{
        int child = fork();
        int c = 5;
        if(child == 0)
        {
                c += 5;
        }
        else
        {
                child = fork();
                c += 10;
                if(child)
                {
                        c += 5;
                }
        }
}
```

What are the different values of the variable c ?

A **Parent = 20, Child 1 = 10, Child 2 = 10**

B **Parent = 15, Child 1 = 15, Child 2 = 10**

C **Parent = 20, Child 1 = 10, Child 2 = 15** Correct Option

Solution: (c)

Explanation:

The piece of code shown creates two processes. Therefore, we have a total of three processes, the parent, the first and second child. Each of these has its own private copy of the variable c.

The first child process executes:

```
int child = fork();
int c = 5;
  /* since child == 0 */
  c += 5;
```

The second child executes:

```
int child = fork();
int c = 5;
  /* since child != 0 */
  child = fork();
  c += 10;
  /* child == 0 now */
```

The parent process executes:

```
int child = fork();
int c = 5;
  /* since child != 0 */
  child = fork();
  c += 10;
    /* since child != 0 */
    c += 5;
```

For the parent, the variable c is 20 before the end of the program.

For the first child (the one created in the first program statement), the variable c will contain the value 10 before the end of the program

the value 10 before the end of the program.

For the second child (the one created in the else clause), the variable c will contain the value 15 before the end of the program.

D **Parent = 15, Child 1 = 10, Child 2 = 15**

Q.21) Max Marks: 2

In the GO back N ARQ sender is sending the 15 packets to the destination with a window size of 4. Every sixth packet is lost and after a packet loss sender is sending one dummy packet outside the window for ensuring everything is correct [dummy packet is an outside packet not the part of the window]. How many number of transmissions will be there?

Correct Answer

Solution: (38)
Explanation:
The 6th packet lost but in GBN we have to transmit the whole window again.
1 2 3 4 5 6* (7 8 9)-> extra window [At the 6th packet lost the 7 , 8 , 9 frames are also sent]
6 7 8* (9 10 11)-> extra window
8 9 10* 11 12 13
10 11 12* 13 14 15
12 13 14* 15
14 15.
4 dummy packets we need to transmit because 4 packets lost.
Total transmissions = 33 + 5 = 38

Q.22) Max Marks: 2

Given a bit pattern of floating-point number in IEEE 754 in double precision format. Which of the following is the correct decimal form of this number?

1	1011110000...0	10000000101

<----------sign bit(1)----------><----------Mantissa bit(52)---------><----------Exponent bit(11)------->

A **-111** Correct Option

Solution: (A)

Solution:

Since the sign bit is 1, therefore, the number is negative. The 11 bits of the exponent is given as:
Exponent bits: 10000000101 => 1024 + 4 + 1 = 1029
Since neither mantissa and exponent is non zero and is within the range, therefore, the representation of decimal form of a given number is normalized. The number will be represented as $(-1)^S \times (1.M) \times 2^{E - 1023}$.
Thus the representation of the given number will be:
=> $(-1)^1 \times (1.10111100..0) \times 2^{1029 - 1023}$
=> $-(1.10111100...0) \times 2^6$
=> -(1101111)
=> -111 (in decimal format)

B **-55.5**

C **-222**

D **111**

Q.23) Max Marks: 2

Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order),
how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?

A **Best fit** Correct Option

Solution: (A)
Explanation:
First-fit:
212K is put in 500K partition
417K is put in 600K partition
112K is put in 288K partition (new partition 288K = 500K - 212K)
426K must wait
Best-fit:
212K is put in 300K partition
417K is put in 500K partition
112K is put in 200K partition
426K is put in 600K partition
Worst-fit:

212K is put in 600K partition
417K is put in 500K partition
112K is put in 388K partition
426K must wait
In this example, best-fit turns out to be the best.

B First fit

C Worst fit

D All of the above

Q.24) Max Marks: 2

For the TCP congestion control we are using the AIMD (Additive increase multiple decrease algorithm). The initial congestion window size is 40 KB. The slow start algorithm starts with 2 KB. What will be the size of a current window after the 10th transmission when at the 10th transmission data get lost and occurred a weak possibility of congestion.

Correct Answer

Solution: (15)
Explanation:

Threshold = 40 KB/ 2 = 20 KB
1st : 2 KB
2nd : 4 KB
3rd: 8 KB
4th: 16 KB
5th : 20 KB(Threshold reached)
6th: 22 KB
7th: 24 KB
8th: 26 KB
9th: 28 KB
10th: 30 KB [weak possibility of congestion] [Threshold (new) = 30/2 = 15 KB]
11th :15 KB

Q.25) Max Marks: 2

Which of the following statements are correct?

I. Boolean expression B(DC' + DC) + AB could not be represented/reduced to 2 literals.
II. The minimal form of boolean expression (A + B) [A' (B' + C')]' + A'B' + A'C' contains 0 literals.

A Only I

B Only II

C Both I and II — Correct Option

Solution: (C)
Solution:

I. B(DC' + DC) + AB:
=> B (D(C + C') + AB
=> BD + AB
=> B(D + A) => minimal expression
Since, its minimal expression consists of 3 literals. Hence, it could not be reduced to 2 literals and thus, this statement is correct.
II. (A + B) [A' (B' + C')]' + A'B' + A'C':
In this expression (A + B) [A' (B' + C')]' is equivalent to:
=> (A + B) [A + BC]
=> A.A + A.BC + B.A + B.BC
=> A + ABC + AB + BC
=> A (1 + BC) + AB + BC
=> A + AB + BC // (1 + BC) = 1
=> A(1 + B) + BC
=> A + BC
Now substituting this output in place of (A + B) [A' (B' + C')]' we will get complete expression as:
=> A + BC + A'B' + A'C'
=> (A + A') (A + B') + BC + A'C' //distributive law over A + A'B'
=> A + B' + BC + A'C' //(A + A') = 1
=> A + (B' + B)(B' + C) + A'C' //distributive law over B' + BC
=> A + B' + C + A'C' //(B + B') = 1
=> (A + A')(A + C') + B' + C //distributive law over A + A'C'
=> A + C' + B' + C //(A + A') = 1
=> A + B' + 1 //(C + C') = 1
=> 1 //(any variable + 1) = 1
Hence, there are no literals in its minimized expression. This statement is also true.

D Neither I and II

close