44. Consider a hard disk with 16 recording surfaces $(0-15)$ having 16384 cylinders $(0-16383)$ and each cylinder contains 64 sectors $(0-63)$. Data storage capacity in each sector is 512 bytes. Data are organized cylinder–wise and the addressing format is <cylinder no., sector no.>. A file of size 42797 KB is stored in the disk and the starting disk location of the file is <1200, 9, 40>. What is the cylinder number of the last sector of the file, if it is stored in a contiguous manner?

   (A) 1281   (B) 1282   (C) 1283   (D) 1284

Ans: (D)

45. Consider the following sequence of micro–operations

   MBR ← PC
   MAR ← X
   PC ← Y
   Memory ← MBR

   Which one of the following is a possible operation performed by this sequence?
   (A) Instruction fetch   (B) Operand fetch
   (C) Conditional branch   (D) Initiation of interrupt service

Ans: (D)

Exp: PC content is stored in memory via MBR and PC gets new address from Y. It represents a function call (routine), which is matching with interrupt service initiation

46. The line graph L(G) of a simple graph G is defined as follows:
   - There is exactly one vertex v(e) in L(G) for each edge e in G.
   - For any two edges e and e' in G, L(G) has an edge between v(e) and v(e'), if and only if e and e' are incident with the same vertex in G.

   Which of the following statements is/are TRUE?
   (P) The line graph of a cycle is a cycle.
   (Q) The line graph of a clique is a clique.
   (R) The line graph of a planar graph is planar.
   (S) The line graph of a tree is a tree.
   (A) P only   (B) P and R only   (C) R only   (D) P, Q and S only

Ans: (B)

47. What is the logical translation of the following statement?
                  "None of my friends are perfect."

   (A) $\exists x \left(F(x) \wedge \neg P(x) \right)$ (B) $\exists x \left(\neg F(x) \wedge P(x) \right)$

   (C) $\exists x \left(\neg F(x) \wedge \neg P(x) \right)$ (D) $\neg \exists x \left(F(x) \wedge P(x) \right)$

Ans: (D)

Exp: "None of my friends are perfect"

   $= \forall x \left(F(x) \rightarrow \neg P(x) \right)$

   $= \forall x \left(\neg F(x) \vee \neg P(x) \right)$

   $= \neg \exists x \left(F(x) \wedge P(x) \right)$

Common Data Questions: 48 & 49

The procedure given below is required to find and replace certain characters inside an input character string supplied in array A. The characters to be replaced are supplied in array oldc, while their respective replacement characters are supplied in array newc. Array A has a fixed length of five characters, while arrays oldc and newc contain three characters each. However, the procedure is flawed

```
void find _ and _ replace (char * A, char * oldc, char * newc) {
        for (int  i = 0; i < 5; i + +)
            for (int  j = 0; j < 3; j + +)
                if (A [i] == oldc [j])      A [i] = newc [j] ;
}
```

The procedure is tested with the following four test cases

(1) oldc = "abc", newc = "dab"   (2) oldc = "cde", newc = "bcd"

(3) oldc = "bca", newc = "cda"   (4) oldc = "abc", newc = "bac"

48. The tester now tests the program on all input strings of length five consisting of characters 'a', 'b', 'c', 'd' and 'e' with duplicates allowed. If the tester carries out this testing with the four test cases given above, how many test cases will be able to capture the flaw?

(A) Only one   (B) Only two   (C) Only three   (D) All four

Ans: (B)

49. If array A is made to hold the string "abcde", which of the above four test cases will be successful in exposing the flaw in this procedure?

(A) None   (B) 2 only   (C) 3 and 4 only   (D) 4 only

Ans: (C)

Common Data Questions: 50 & 51

The following code segment is executed on a processor which allows only register operands in its instructions. Each instruction can have almost two source operands and one destination operand. Assume that all variables are dead after this code segment

```
c = a + b;
d = c * a;
e = c + a;
x = c * c;
if (x > a) {
    y = a * a;
}
else {
    d = d * d;
    e = e * e;
}
```

50. Suppose the instruction set architecture of the processor has only two registers. The only allowed compiler optimization is code motion, which moves statements from one place to another while preserving correctness. What is the minimum number of spills to memory in the compiled code?

(A) 0   (B) 1   (C) 2   (D) 3

Ans: (C)

51. What is the minimum number of registers needed in the instruction set architecture of the processor to compile this code segment without any spill to memory? Do not apply any optimization other than optimizing register allocation

(A) 3   (B) 4   (C) 5   (D) 6

Ans: (B)

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each

Statement for Linked Answer Questions: 52 & 53

Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values.

$F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$ is a set of functional

dependencies (FDs) so that F^+ is exactly the set of FDs that hold for R

52.   How many candidate keys does the relation R have?
       (A) 3   (B) 4   (C) 5   (D) 6
Ans: (B)
Exp: Candidate keys are AD, BD, ED and FD

53.   The relation R is
       (A) in INF, but not in 2NF   (B) in 2NF, but not in 3NF
       (C) in 3NF, but not in BCNF   (D) in BCNF
Ans: (A)
Exp: $A \rightarrow BC, B \rightarrow CFH$ and $F \rightarrow EG$ are partial dependencies. Hence it is in 1NF but not in 2NF

Statement for Linked Answer Questions: 54 & 55

A computer uses 46–bit virtual address, 32–bit physical address, and a three–level paged page table organization. The page table base register stores the base address of the first–level table (T_1) ,which occupies exactly one page. Each entry of T_1 stores the base address of a page of the second–level table (T_2). Each entry of T_2 stores the base address of a page of the third–level table (T_3) Each entry of T_3 stores a page table entry (PTE). The PTE is 32 bits in size. The processor used in the computer has a 1 MB 16 way set associative virtually indexed physically tagged cache. The cache block size is 64 bytes.

54. What is the size of a page in KB in this computer?
    (A) 2   (B) 4   (C) 8   (D) 16

Ans:

55. What is the minimum number of page colours needed to guarantee that no two synonyms map to different sets in the processor cache of this computer?
    (A) 2   (B) 4   (C) 8   (D) 16

Ans:

Q. No. 56 – 60 Carry One Mark Each

56. Complete the sentence:
    Universalism is to particularism as diffuseness is to _____
    (A) specificity   (B) neutrality   (C) generality   (D) adaptation

Ans: (A)
     The relation is that of antonyms

57. Were you a bird, you _____ in the sky.
    (A) would fly   (B) shall fly
    (C) should fly   (D) shall have flown

Ans: (A)

58. Which one of the following options is the closest in meaning to the word given below?
    Nadir
    (A) Highest   (B) Lowest   (C) Medium   (D) Integration

Ans: (B)
     Nadir in the lowest point on a curve

59. Choose the grammatically INCORRECT sentence:
    (A) He is of Asian origin
    (B) They belonged to Africa
    (C) She is an European
    (D) They migrated from India to Australia

Ans: (C)

60. What will be the maximum sum of 44, 42, 40, … ?
    (A) 502   (B) 504   (C) 506   (D) 500

Ans: (C)
     The maximum sum is the sum of 44, 42,- - - - -2.
      The sum of 'n' terms of an AP

$$= \frac{n}{2} \left[2a + (n-1)d \right]$$

In this case, n = 22, a = 2 and d = 2

$\therefore$ Sum $= \frac{11}{2} \left[4 + 21 \times \right] = 11 \times 46 = 506$

Q. No. 61 − 65 Carry Two Marks Each

61. Out of all the 2-digit integers between 1 and 100, a 2-digit number has to be selected at random. What is the probability that the selected number is not divisible by 7?

    (A) 13/90   (B) 12/90   (C) 78/90   (D) 77/90

Ans: (D)

The number of 2 digit multiples of $7 = 13$

$\therefore$ Probability of choosing a number

Not divisible by $7 = \dfrac{90-13}{90} = \dfrac{77}{90}$

62. A tourist covers half of his journey by train at 60 km/h, half of the remainder by bus at 30 km/h and the rest by cycle at 10 km/h. The average of the tourist in km/h during his entire journey is

    (A) 36   (B) 30   (C) 24   (D) 18

Ans: (C)

Let the total distance covered be 'D'

Now, average speed $= \dfrac{D}{\text{Total time taken}}$

$= \dfrac{D}{\left(\dfrac{\dfrac{D}{2}}{60} + \dfrac{\dfrac{D}{4}}{30} + \dfrac{\dfrac{D}{4}}{10}\right)} = \dfrac{1}{\dfrac{1}{120} + \dfrac{1}{120} + \dfrac{1}{40}} = \dfrac{120}{5} = 24\,\text{km/hr}$

63. Find the sum of the expression

    $\dfrac{1}{\sqrt{1}+\sqrt{2}} + \dfrac{1}{\sqrt{2}+\sqrt{3}} + \dfrac{1}{\sqrt{3}+\sqrt{4}} + \ldots + \dfrac{1}{\sqrt{80}+\sqrt{81}}$

    (A) 7   (B) 8   (C) 9   (D) 10

Ans: (B)

The expression can be written as

$\dfrac{\left(\sqrt{2}\right)^2 - \left(\sqrt{1}\right)^2}{\sqrt{1}+\sqrt{2}} + \dfrac{\left(\sqrt{3}\right)^2 - \left(\sqrt{2}\right)^2}{\sqrt{2}+\sqrt{3}} + ----- \dfrac{\left(\sqrt{81}\right)^2 - \left(\sqrt{80}\right)^2}{\sqrt{80}+\sqrt{81}}$

$= \dfrac{\left(\sqrt{2}-\sqrt{1}\right)\left(\sqrt{1}+\sqrt{2}\right)}{\left(\sqrt{1}+\sqrt{2}\right)} + ------ + \dfrac{\left(\sqrt{81}-\sqrt{80}\right)\left(\sqrt{81}+\sqrt{80}\right)}{\sqrt{80}+\sqrt{81}}$

64. The current erection cost of a structure is Rs. 13,200. If the labour wages per day increase by 1/5 of the current wages and the working hours decrease by 1/24 of the current period, then the new cost of erection in Rs. is

    (A) 16,500   (B) 15,180   (C) 11,000   (D) 10,120

Ans: (B)

Let 'W' be the labour wages, and 'T' be the working hours.

Now, total cost is a function of $W \times T$

Increase in wages $= 20\%$

$\therefore$ Revised wages $= 1.2\ W$

Decrease in labour time $= \left(\dfrac{100}{24}\right)\%$

$\therefore$ Revised time $= \left(1 - \dfrac{1}{24}\right)T = \dfrac{23}{24}\ T$

$\therefore$ Revised Total cost $= 1.2 \times \dfrac{23}{24}\ WT\ = 1.15\ WT$

$\qquad\qquad\qquad\qquad = 1.15 \times 13200 = 15180$

65. After several defeats in wars, Robert Bruce went in exile and wanted to commit suicide. Just before committing suicide, he came across a spider attempting tirelessly to have its net. Time and again, the spider failed but that did not deter it to refrain from making attempts. Such attempts by the spider made Bruce curious. Thus, Bruce started observing the near-impossible goal of the spider to have the net. Ultimately, the spider succeeded in having its net despite several failures. Such act of the spider encouraged Bruce not to commit suicide. And then, Bruce went back again and won many a battle, and the rest is history.

Which one of the following assertions is best supported by the above information?

(A) Failure is the pillar of success

(B) Honesty is the best policy

(C) Life begins and ends with adventures

(D) No adversity justifies giving up hope

Ans: (D)