University of Engineering & Management, Kolkata
Term-1 Examination, September, 2023
Programme Name: B. Tech in CSE/CSE(AIML)/CSE (IOT, CYS, BCT)
Semester: 5th
Course Name: ESP-SDP –V
Course Code: HSMCCSE502

Full Marks:30 **Time: 1 Hour**

Part – 1 ESP

Part A
Attempt any 4 out of 7questions
Each question carries 2 Marks (2 X 4)

1. Define some properties of Priority Queue.

2. What is the worst-case time complexity of selection sort algorithm for **n** elements? Show an example.

3. What is Doubly Linked List? What is the access principle of a stack?

4. What is the worst-case time complexity of quick sort algorithm for **n** elements? Show the divide-conquer tree.

5. What number of Binary Trees generates with **3** nodes which when traversed by pre-order gives the sequence **A, B, C**?

6. Evaluate the recurrence relation capturing the optimal execution time of the Towers of Hanoi problem with n discs. Show an example.

7. Find the decreasing order of asymptotic complexity of functions **f1, f2, f3** and **f4.**
$f1(n)=2^n$; $f2(n)=n^{3/2}$; $f3(n)=n\log_2 n$; $f4(n)=n^{\log 2n}$

Part B
Attempt any 1out of 2questions
Each question carries 3 Marks (3 X 1)

8. A scheme for storing binary trees in an array **X** is as follows. Indexing of **X** starts at **1** instead of **0**. The root is stored at **X [1]**. For a node stored at **X[i]**, the left child, if any, is stored in **X[2i]** and the right child, if any, in **X[2i+1]**. To be able to store any binary tree on n vertices, the minimum size of **X** should be _____.

9. A hash table contains **10** buckets and uses linear probing to resolve collisions. The key values are integers, and the hash function used is key

% 10. If the values 43, 165, 62, 123, 142 are inserted in the table, in what location would the key value 142 be inserted? Show the complete hash table with complete insertion procedure.

Part - C

Attempt any 1 out of 2 questions
Each question carries 4 Marks (4 X 1)

10 Consider the following three functions: [P1], [P2] and [P3]

[P1]
```
int *g(void)
{
intx=10;
return (& x);
}
```

[P2]
```
int *g(void)
{
int *px;
*px=10;
return px;
}
```

[P3]
```
int *g(void)
{
int *px
px=(int*)malloc (size of (int));
*px=10;
return px;
}
```

Which of the above three functions are likely to cause problems with pointers ?

11 Let **S** be a stack of size $n \geq 1$. Starting with the empty stack, suppose we **Push** the first **n** natural numbers in sequence, and then perform **n Pop** operations. Assume that **Push** and **Pop** operation take **X** seconds each, and **Y** seconds elapse between the end of the one such stack operation and the start of the next operation. For $m \geq 1$, define the stack-life of **mcs** the time elapsed from the end or **Push (m)** to the start of the **Pop** operation that removes **m** from **S**. The average stack-life of an element of this stack is_____ .

Part – 2 SDP

Attempt any 5 out of 8 questions
Each question carries 3 Marks (3 X 5)

12. **Select the most appropriate option to substitute the underlined segment in the given sentence. If there is no need to substitute it, select 'No substitution required'.**

A. A better plan is to going and has a lavish dinner at a fine restaurant.
1. is to go and have
2. No substitution required
3. is to gone and have
4. was to going and have

B. It was apparent that the girl was heading into a serious disaster.
1. heading along
2. heading for
3. heading down
4. heading out

13. **Direction: In each of the questions below, a sentence is given with two blanks that indicate that some parts are missing. Identify the correct pair of words that fit in the sentence to make it grammatically and contextually correct.**

Only a third in India are _____ saving for their retirement while just 33 per cent of working-age respondents globally are _____ anything aside for their later life.

A. Hardly, saving
B. Regularly, putting
C. Constantly, setting
D. Diligently, Meticulously

14. Shivam and Vikas walk up an escalator (moving stairway). The escalator moves at a constant speed. Shivam takes three steps for every two of Vikas's steps. Shivam gets to the top of the escalator after having taken 25 steps, while Vikas (because his slower pace lets the escalator do a little more of the work) takes only 20 steps to reach the top. If the escalator were turned off, how many steps would they have to take to walk up?
A. 40
B. 50
C. 60
D. 80

15. Vande-Bharat Express from Ahmedabad to Chennai leaves Ahmedabad at 6:30 am and travels at 50km per hour towards Baroda situated 100 kms away. At 7:00 am Howrah – Ahmedabad express leaves Baroda towards Ahmedabad and travels at 40 km per hour. At 7:30 Mr. Shah, the traffic controller at Baroda realises that both the trains are running on the same track. How much time does he have to avert a head-on collision between the two trains?
A. 15 minutes

B. 20 minutes
C. 25 minutes
D. 30 minutes

16. Amit. Basheer, Chris. Dharam and Esso are 5 friends. All of them are of different heights. The tallest person's position is numbered 1, the next tallest 2, and so on, till the shortest whose position number is 5.

I. The sum of Amit's position number and Esso 's position number is equal to the sum of Dharam's position number and Chris' position number.
II. Chris is not the shortest and Amit is not the tallest.
III. Chris is shorter than Amit, and Dharam is shorter than Basheer.

Who is the tallest?

1. Basheer
2. Amit
3. Esso
4. Either Basheer or Amit

17. In a wrestling championship, five persons — Andy, Bumrah, Clarke, David and Hussey — secured the first five ranks, in the same order. The weight of each of the five persons is a distinct natural number.

The following information is known regarding their weights:

(1) Clarke is the heaviest person and Bumrah the second heaviest.

(2) Andy is heavier than David.

(3) The weight of the lightest person among the five is 54 kg and it is not Hussey.

(4) The weight of the heaviest person is 87 kg.

(5) The weight of one of the persons is 19 kg more than that of Hussey.

(6) The person whose weight is 82 kg secured a better rank than the person whose weight is 67 kg.

What is the Weight (in kg) of Andy?

18. **Directions (18-19) : Study the following table carefully and answer the questions given beside.**

The given table shows the number of books published in different months and the second table shows the percentage of number of books published in the respective months by a publisher.

Note: Number of books published (in a month) = Number of books sold + Number of unsold books

Month	Number of books published	Percentage of books sold out of number of books published in that month
January	480	25%
February	360	20%
March	240	15%
April	320	25%
May	420	15%

Out of the number of books sold in January, 30% are academic books. The number of academic books sold in January is what percentage of the number of books sold in February?

A. 50%
B. 30%
C. 80%
D. 40%

19. The given data is the number of students studying in colleges A,B, C and D in the year 2009. The mentioned colleges offer courses in three streams only – Arts, Commerce and Science.

Total students' strength = students studying (Arts + Commerce + Science).

Colleges	% of students studying in Arts (out of total student strength)	% of students studying Commerce (out of total student strength)	Number of students studying Science (out of total student strength)
A	20	55	750
B	30	20	750
C	25	25	1040
D	50	30	960

Number of students studying Arts in college C is what percent of number of students studying Arts in college D?

A. 18(2/3)
B. 21(2/3)
C. 17(1/2)
D. 20(3/2)