Started on	Wednesday, 23 September 2020, 2:15 PM
State	Finished
Completed on	Wednesday, 23 September 2020, 2:45 PM
Time taken	29 mins 54 secs
Grade	**10** out of 21 (**48**%)

Question **1**

Correct

Mark 1 out of 1

What is the tightest asymptotic runtime for the following piece of code?

```
void foo() {
  int i,j;
  for (i=1; i<n; i++)
    for(j=1; j<log(i); j++)
      print("running foo")
}
```

Select one or more:

- $O(n^2 log\ n)$
- $O(n)$
- $O(log\ n)$
- $O(nlog\ n)$ ✔

Your answer is correct.

The correct answer is: $O(nlog\ n)$

Question **2**

Incorrect

Mark 0 out of 2

Suppose we want to find the smallest and largest elements in a sequence of integers using a Divide and Conquer algorithm. The algorithm divides the input into two equal halves in the Divide phase (just like Mergesort). What is the lowest number of comparisons needed by this algorithm?

Select one or more:

- $2(n-1)$
- $n/2$
- n ✖
- None of the others
- $1.5n-2$

Your answer is incorrect.

The correct answer is: $1.5n-2$

Question **3**

Correct

Mark 1 out of 1

Suppose we want to search for a given integer **r** in an array **A** of **n** integers. This search can be done in $O(log\ n)$ time if

Select one or more:

- For some known value $0 < i \leq n$, array A is sorted and rotated by i places. ✔
- None of the others
- A is not sorted
- For some unknown value $0 < i \leq n$, array A is sorted and rotated by i places. ✔
- Array A is sorted ✔

Your answer is correct.

The correct answers are: Array A is sorted, For some known value $0 < i \leq n$, array A is sorted and rotated by i places., For some unknown value $0 < i \leq n$, array A is sorted and rotated by i places.

Question **4**

Incorrect

Mark 0 out of 1

Which of the following statements is/are TRUE?

Select one or more:

- [ ] None of the others
- [ ] $\sqrt{log\ n} = O(log\ log\ n)$
- [x] $(n+k)^m = \Theta(n^m)$ ✔
- [x] $2^{2n+1} = O(2^n)$ ✖
- [x] $2^{n+1} = O(2^n)$ ✔

Your answer is incorrect.

The correct answers are: $(n+k)^m = \Theta(n^m)$, $2^{n+1} = O(2^n)$

Question **5**

Not answered

Marked out of 1

The solution for the recurrence relation

$T(n) = 2T(n-1) + n$

$T(1) = 1$

is

Select one or more:

- [ ] $2^n - n$
- [ ] $2^n + n$
- [ ] None of the others
- [ ] $2^{n+1} - 2n - 2$
- [ ] $2^{n+1} - n - 2$

Your answer is incorrect.

The correct answer is: $2^{n+1} - n - 2$

Question **6**

Correct

Mark 1 out of 1

Let $f(n) = n^2 log\ n$ and $g(n) = n(logn)^{10}$ be two positive functions of n. Which of the following statements is correct?

Select one or more:

- [ ] None of the others
- [x] $g(n) = O(f(n)); f(n) \neq O(g(n))$ ✔
- [ ] $f(n) = O(g(n)); g(n) \neq O(f(n))$
- [ ] $f(n) = O(g(n)); g(n) = O(f(n))$
- [ ] $f(n) \neq O(g(n)); g(n) \neq O(f(n))$

Your answer is correct.

The correct answer is: $g(n) = O(f(n)); f(n) \neq O(g(n))$

Question **7**

Incorrect

Mark 0 out of 1

Let $f(n) = 80n + log\ n$ and $g(n) = (logn)^2 + 3n$ be two positive functions of n. Which of the following statements is correct?

Select one or more:

- $f(n) = O(g(n)); g(n) = O(f(n))$
- $f(n) \neq O(g(n)); g(n) \neq O(f(n))$
- None of the others
- $f(n) = O(g(n)); g(n) \neq O(f(n))$ ✖
- $g(n) = O(f(n)); f(n) \neq O(g(n))$

Your answer is incorrect.

The correct answer is: $f(n) = O(g(n)); g(n) = O(f(n))$

Question **8**

Correct

Mark 1 out of 1

"In an instance of the Stable Matching Problem
there exists a man m and a woman w
such that m is ranked first on the preference list of w and w is ranked first on the
in every stable matching S for this instance, the pair (m, w) belongs to S.
"

The above statement is:

Select one or more:

- Always False
- Mostly True, but False for some such instances.
- Mostly False, but True for some such instances.
- Always True ✔

Your answer is correct.

The correct answer is: Always True

Question **9**

Correct

Mark 1 out of 1

In the implementation of Gale Shapley's Stable Matching algorithm what happens to the program's runtime if the women's preference lists are stored as they are (like that of the men), and no inverse preference list is computed ? (The program is run without any inverse preference lists, the preference list of any woman is an array, the array's first element being her most preferred man, and so on.)

Select one or more:

- [ ] The program's runtime is $O(n^2)$
- [ ] The program's runtime is $O(nlog\ n)$
- [ ] None of the others
- [x] The program's runtime is $O(n^3)$

Your answer is correct.

The correct answer is: The program's runtime is $O(n^3)$

Question **10**

Correct

Mark 1 out of 1

For the following instance of men and women, what would be the resulting matching if Gale Shapley's algorithm is run, but with the roles of men and women exchanged? (The women do the proposing and the men accept/reject the proposals?)

Men = {Arjun, Babu, Chetan, Dev, Eshan}

Women = {Poonam, Ritu, Sonam, Tanu, Urmila}

Men's Preferences:

Arjun	Poonam	Ritu	Sonam	Tanu	Urmila
Babu	Ritu	Poonam	Tanu	Urmila	Sonam
Chetan	Urmila	Tanu	Poonam	Ritu	Sonam
Dev	Tanu	Poonam	Urmila	Sonam	Ritu
Eshan	Sonam	Urmila	Tanu	Ritu	Poonam

Women's Preferences:

Poonam	Arjun	Eshan	Chetan	Dev	Babu
Ritu	Arjun	Babu	Dev	Eshan	Chetan
Sonam	Chetan	Babu	Dev	Arjun	Eshan
Tanu	Dev	Chetan	Eshan	Arjun	Babu
Urmila	Chetan	Eshan	Dev	Babu	Arjun

Babu — Ritu ✔

Dev — Tanu ✔

Eshan — Sonam ✔

Arjun — Poonam ✔

Chetan — Urmila ✔

Your answer is correct.

The correct answer is: Babu → Ritu, Dev → Tanu, Eshan → Sonam, Arjun → Poonam, Chetan → Urmila

Question **11**

Correct

Mark 1 out of 1

The runtimes of two Divide and Conquer algorithms A and B, to solve a given problem are

T_A👎 $= 2T_A(n/3) + 1$

and

T_B👎 $= 5T_B(n/4) + n$

Which of the following statements are True?

Select one or more:

- ☐ Both algorithms have the same runtime
- ☐ None of the above
- ☑ Algorithm A is faster ✔
- ☐ Algorithm B is faster

Your answer is correct.

The correct answer is: Algorithm A is faster

Question **12**

Correct

Mark 1 out of 1

Suppose we want to find out if there an index k such that A[k] = k, where A is a sorted array of distinct integers.

Select one or more:

- ☑ There is a $O(log\ n)$ time algorithm to solve this problem.

There is a O(log n) time algorithm to solve this problem. ✔

- [ ] None of the others
- [x] The fastest algorithm is a Divide and Conquer algorithm ✔
- [ ] We can not solve this problem in less than $O(n)$ worst case time.

Your answer is correct.

The correct answers are: There is a $O(log\ n)$ time algorithm to solve this problem.

There is a O(log n) time algorithm to solve this problem.
, The fastest algorithm is a Divide and Conquer algorithm

Question **13**

Not answered

Marked out of 1

Consider the following piece of code:

```
foo(a,b)
 if b==1
    return a
 x = foo(a, ⌊b/2⌋)
 if b is even
   return x.x
 else
   return x.x.a
```

Select one or more:

- [ ] The program returns the value b^a
- [ ] The program runs in time $O(n)$
- [ ] None of the others
- [ ] The program returns the value a^b
- [ ] The program runs in time $O(log\ n)$

Your answer is incorrect.

The correct answers are: The program runs in time $O(log\ n)$

, The program returns the value a^b

Question **14**

Incorrect

Mark 0 out of 1

Suppose in the selection algorithm, instead of picking an approximate median we always picked the first element in the array as the pivot element for partition.

The recurrence relation for the runtime of the selection algorithm would be:

Select one or more:

- [x] $T(n) = T(n-1) + O(1)$ ✖
- [ ] $T(n) = T(n-1) + O(n)$
- [ ] $T(n) = 2T(n/2) + O(n)$
- [ ] $T(n) = 3T(n/4) + T(n/10) + O(n)$
- [ ] None of the others

Your answer is incorrect.

The correct answer is: $T(n) = T(n-1) + O(n)$

Question **15**

Incorrect

Mark 0 out of 1

Which of the following describes the manner in which a backtracking algorithm explores the Recursion Tree?

Select one or more:

- [ ] A Post order traversal
- [x] A Depth first search ✔
- [ ] A Breadth first search
- [ ] None of the others
- [x] A Pre order traversal ✖

Your answer is incorrect.

The correct answer is: A Depth first search

Question **16**

Correct

Mark 1 out of 1

What happens after a backtracking algorithm reaches a complete solution?

Select one or more:

- [ ] It backtracks to the root
- [x] It backtracks to the parent node and continues the search ✔
- [ ] It continues the search on its children.
- [ ] It always terminates

Your answer is correct.

The correct answer is: It backtracks to the parent node and continues the search

Question **17**

Incorrect

Mark 0 out of 1

Which of the following could be described as a combinatorial optimization problem?

Select one or more:

- [x] Subset Sum Problem ✖
- [x] Finding a minimum spanning tree in a graph. ✔
- [x] Traveling Salesman Problem ✔
- [x] Find the shortest path between two nodes in graphs ✔

Your answer is incorrect.

The correct answers are: Find the shortest path between two nodes in graphs, Traveling Salesman Problem, Finding a minimum spanning tree in a graph.

Question **18**

Incorrect

Mark 0 out of 1

$f(n) = O(g(n))$ implies that $2^f(n) = O(2^g(n))$

Select one:

- (•) True ✖
- ( ) False

The correct answer is 'False'.

Question **19**

Incorrect

Mark 0 out of 1

For an
instance of the Stable Matching Problem, if there exists a perfect matching that stable due to m and w wanting to be together, then (m, w) will be in every stable instance.

Select one or more:

- [ ] The above statement is True for all instances.
- [x] The above statement is False for all instances. ✖
- [ ] The above statement is False for some instances.
- [ ] None of the others

Your answer is incorrect.

The correct answer is: The above statement is False for some instances.

Question **20**

Correct

Mark 1 out of 1

What is the tightest asymptotic solution for the following recurrence relation?

$T(n) = T(\sqrt{n}) + 1$

Select one or more:

- [ ] $O(n)$
- [ ] $O(log\ n)$
- [x] $O(log\ log\ n)$ ✔
- [ ] None of the others

Your answer is correct.

The correct answer is: $O(log\ log\ n)$

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