Started on	Thursday, 17 September 2020, 10:20 AM
State	Finished
Completed on	Thursday, 17 September 2020, 10:49 AM
Time taken	29 mins 22 secs
Marks	11/20
Grade	**6** out of 10 (**55**%)

Question **1**

Incorrect

Mark 0 out of 2

Which of the following statements are TRUE?

Select one or more:

☑ $n^{0.1} = \Omega((\log n)^8)$

✔

☑ $n^{1.01} = O(n\log^2 n)$

✖

☑ $2^n = \Theta(2^{n+1})$

✔

☑ $\log 2n = \Omega(\log 3n)$

✔

Your answer is incorrect.

The correct answers are: $n^{0.1} = \Omega((\log n)^8)$

, $\log 2n = \Omega(\log 3n)$

, $2^n = \Theta(2^{n+1})$

Question **2**

Incorrect

Mark 0 out of 1

If $f(n) = n^{1/2}$ and $g(n) = 5^{\log_2 n}$, then

Select one or more:

☐ None of the others

☑ $f(n) = O(g(n))$

✔

☐ $f(n) = o(g(n))$

☐ $f(n) = \Omega(g(n))$

Your answer is incorrect.

The correct answers are: $f(n) = O(g(n))$

, $f(n) = o(g(n))$

Question 3

Incorrect

Mark 0 out of 1

If $\Sigma_{i=0}^{n} i^2 = X$ then X is

Select one or more:

☑ $o(n^4)$

✔

☐ $\Theta(n^3)$

☐ $\Theta(n^2)$

☐ $\Omega(n^3)$

Your answer is incorrect.

The correct answers are: $\Theta(n^3)$

, $o(n^4)$

Question 4

Incorrect

Mark 0 out of 1

If $C(n)$ denotes the worst case runtime and $D(n)$ denotes the average case runtime of an algorithm, then which of the following is always true?

Select one or more:

☑ $C(n) = o(D(n))$

✖

☐ $C(n) = \Theta(D(n))$

☑ $C(n) = \Omega(D(n))$

✔

☐ None of the others

Your answer is incorrect.

The correct answer is: $C(n) = \Omega(D(n))$

Question **5**

Incorrect

Mark 0 out of 1

What is the runtime of the following procedure?

$\text{foo}(n)$

if $(n \leq 2)$ then return 1 else return foo$(\sqrt{n})$

Select one or more:

- ☑ $O(n)$

  ✖

- ☐ $O(log\ n)$

- ☐ $O(log\ log\ n)$

- ☐ $O(1)$

Your answer is incorrect.

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

Question **6**

Correct

Mark 1 out of 1

"In every instance of the [Stable Matching](#) *Problem, there is a* [stable matching](#) *containing a pair (m, w) such that m is ranked first on the preference list of w and w is ranked first on the preference list of m "*

Select one:

- ○ True

- ◉ False ✔

The correct answer is 'False'.

Question **7**

Correct

Mark 1 out of 1

The runtime of the Gale Shapley algorithm for an input instance consisting of n men and n women is

Select one or more:

- ☐ $O(nlog\ n)$

- ☑ $O(n^2)$

  ✔

- ☐ None of the others

- ☐ $O(n)$

Your answer is correct.

The correct answer is: $O(n^2)$

Question **8**

Correct

Mark 1 out of 1

"In every Stable Marriage problem instance, there always exists a stable matching where for every matched pair (m, w), it is true that both m and w do not have the other as their least preferred partner."

Select one:
- ○ True
- ◉ False ✔

The correct answer is 'False'.

Question **9**

Correct

Mark 2 out of 2

Consider the Stable Matching problem with n men and n women, where for some value k, where $1 \le k \le n$, there are k *good* men and k *good* women. So there are $n - k$ *bad* men and $n - k$ *bad* women. Everyone would rather marry any good person than any bad person. That is, any person's preference list, the first k entries are the good people of the opposite gender (in some order), and the next $n - k$ entries are of the bad people of the opposite gender (in some order).

For this scenario which of the following statements are TRUE?

Select one or more:
- ☑ In every stable matching, every good man is married to a good woman ✔
- ☑ In every stable matching, every bad man is married to a bad woman ✔
- ☐ There may exist some stable matchings where a good man is married to a bad woman
- ☐ There may exist some stable matchings where a bad man is married to a good woman

Your answer is correct.

The correct answers are: In every stable matching, every good man is married to a good woman, In every stable matching, every bad man is married to a bad woman

Question **10**

Correct

Mark 1 out of 1

A worst valid partner of a person p is

Select one or more:
- ☐ None of the others
- ☐ The person p' of the opposite gender who is least preferred by p.
- ☐ The last person p' to whom p proposes in the Gale-Shapley algorithm.
- ☑ The least preferred person p' of the opposite gender such that there is a stable matching containing the pair (p, p') ✔

Your answer is correct.

The correct answer is: The least preferred person p' of the opposite gender such that there is a stable matching containing the pair (p, p')

Question 11

Correct

Mark 1 out of 1

Suppose you have to choose between the following two algorithms:

- Algorithm A solves problems of size n by recursively solving two subproblems of size $n - 1$ and then combining the solutions in constant time.
- Algorithm B solves problems of size n by dividing them into nine subproblems of size $n/3$, recursively solving each subproblem, and then combining the solutions in $O(n^2)$ time.

Which of the following statements are true?

Select one or more:

☐ None of the others

☐ Runtimes of algorithm A and B are $O(n^2)$ and $O(n^2 log\ n)$ respectively; A is the faster algorithm

☑ Runtimes of algorithm A and B are $O(2^n)$ and $O(n^2 log\ n)$ respectively; B is the faster algorithm

✔

☐ Runtimes of algorithm A and B are $O(2^n)$ and $O(n^2)$ respectively; B is the faster algorithm

Your answer is correct.

The correct answer is: Runtimes of algorithm A and B are $O(2^n)$ and $O(n^2 log\ n)$ respectively; B is the faster algorithm

Question 12

Incorrect

Mark 0 out of 1

How many lines, in asymptotic notation, does the following program print? Assume n is a power of 2.

function foo(n)

  if n > 1:

    print("still going")

    foo(n/2)

    foo(n/2)

Select one or more:

☑ $\Theta(n^2)$

✘

☐ None of the others

☐ $\Theta(nlog\ n)$

☐ $\Theta(n)$

Your answer is incorrect.

The correct answer is: $\Theta(n)$

Question **13**
Not answered
Marked out of 1

Recall that in the linear time selection algorithm, we picked our pivot x to be an approximate median of the sequence A. Suppose we instead picked x to be any arbitrary element of the sequence A. Then which of the following statements are True?

Select one or more:

☐ The modified algorithm is still correct

☐ The modified algorithm no longer has a linear worst case runtime.

☐ The modified algorithm is incorrect

☐ None of the others

☐ The modified algorithm still has a linear worst case runtime.

Your answer is incorrect.

The correct answers are: The modified algorithm is still correct, The modified algorithm no longer has a linear worst case runtime.

Question **14**
Correct
Mark 1 out of 1

While merging two sorted lists of size m and n into a single sorted list of size m+n, the number of comparisons is

Select one or more:

☐ $O(n)$

☑ $O(m + n)$

✔

☐ $O(log m + log n)$

☐ $O(m)$

Your answer is correct.

The correct answer is: $O(m + n)$

Question **15**
Incorrect
Mark 0 out of 1

A collection of n strings, where each string has n characters, is sorted using Mergesort. What is the worst case runtime of this procedure? Strings are sorted based on the lexicographic order

Select one or more:

☐ $O(n log n)$

☐ $O(n^2 log n)$

☐ None of the above.

☑ $O(n^2)$

✘

Your answer is incorrect.

The correct answer is: $O(n^2 log n)$

Question **16**

Correct

Mark 1 out of 1

The recurrence relation for the runtime of the Tower of Hanoi problem is

Select one or more:

☐ $T(n) = 2T(n-1) + O(n)$

☐ $T(n) = 2T(n/2) + O(1)$

☑ None of the others ✔

☐ $T(n) = 2T(n-2) + O(1)$

Your answer is correct.

The correct answer is: None of the others

Question **17**

Correct

Mark 1 out of 1

What is the number of moves to solve the Tower of Hanoi problems for n disks?

Select one or more:

☑ $2^n - 1$

✔

☐ 2^n

☐ $n^2 - 1$

☐ n^2

Your answer is correct.

The correct answer is: $2^n - 1$

Question 18

Correct

Mark 1 out of 1

What is the asymptotic runtime of 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:

☐ $O(log\ n)$

☐ $O(n^2 log\ n)$

☐ $O(n)$

☑ $O(nlog\ n)$

✔

Your answer is correct.

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

◄ Lab Test 1

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