Quiz 2 - Recursion, Recurrence Relations and Divide & Conquer

Due Jan 18 at 11:59pm **Points** 10 **Questions** 10
Available until Jan 19 at 11:59pm **Time Limit** None **Allowed Attempts** 2

Instructions

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This quiz will test your understanding of the material covered so far this week (MLOs).

This is an online quiz. There will be no time limit to the quiz. You can attempt the quiz twice and the best of the scores will be retained. This is open notes and open internet quiz but refrain from discussing with anybody during the exam.

Note that this test cannot be taken past the due date for any credit.

This quiz is worth 10 points.

You can view the correct answers here after the due date.

Attempt History

	Attempt	Time	Score
KEPT	Attempt 2	4 minutes	10 out of 10
LATEST	Attempt 2	4 minutes	10 out of 10
	Attempt 1	12 minutes	9 out of 10

Score for this attempt: **10** out of 10
Submitted Jan 18 at 2:33pm
This attempt took 4 minutes.

Question 1 — 1 / 1 pts

Which of the following correctly defines what a 'recurrence relation' is?

T(n)=T(n-1)+2n, T(0)=1

T(n) = 2(1+n), T(0) = 2

An equation (or inequality) that represents n^{th} iteration of a sequence in terms of n. That includes an initial condition.

Correct!

An equation (or inequality) that relates the n^{th} element of a sequence to its predecessors (recursive case). This includes an initial condition (base case).

Question 2

1 / 1 pts

Given the following algorithm

```
foo(n)
   if n <= 1
       return 1
   else
       x = foo(n-1)
       for i = 1 to n
           x = x + i
       return x
```

Determine the asymptotic running time. Assume that addition can be done in constant time.

$\Theta(n)$

$\Theta(2^n)$

O(n)

Correct!

$\Theta(n^2)$

Question 3

1 / 1 pts

Solve the following recurrence by giving the tightest bound possible.

T(n) = 4T(n/4) + 4n

- $\Theta(\log n)$
- $\Theta(n)$
- **$\Theta(n \log n)$** — Correct!
- $\Theta(n^2)$

Question 4

1 / 1 pts

What is the solution of $T(n) = 2T(n/2) + n^2$ using the Master theorem?

- $\Theta(n\ lg\ n)$, Case 2
- $\Theta(n^2)$, Case 1
- **$\Theta(n^2)$, Case 3** — Correct!
- $\Theta(n\ lg\ n)$, Case 3

Question 5

1 / 1 pts

What is the solution of $T(n) = 2T(n/2) + n/logn$ using the Master theorem?

$T(n) = \Theta(nlog_2n)$, Case 2

$T(n) = \Theta(nlog_2n)$, Case 1

Correct!

Master Method does not apply

Example4 of exploration: This looks like it might satisfy Case 2, but notice that k = -1, so it does not satisfy the condition for the Master Method, so we cannot apply it.

$T(n) = \Theta(n^2)$, Case 1

Question 6

1 / 1 pts

We can use Divide and Conquer technique to solve a problem in which of the following scenarios?

The subproblems are overlapping so we don't have to solve them over and over again

rect!

We can break the problem into several subproblems that are similar to the original problems but smaller in size

The complexity is exponential to solve the entire problem

None of the options

Question 7

1 / 1 pts

What would be the time complexity of the following algorithm?

```
int sum = 0;
for (i = 0; i < n; i++) {
    for (j = 0; j < n; j++) {
        for (k = 0; k < n; k++) {
            if (i == j == k) {
                for (l = 0; l < n*n*n; l++) {
                    sum = i + j + k + l;
                }
            }
        }
    }
}
```

Correct!

- (selected) $\Theta\left(n^4\right)$
- $\Theta\left(n^4 \log n\right)$
- $O\left(n^3\right)$
- $\Theta\left(n^3\right)$

Question 8

1 / 1 pts

What would be the time complexity of the following algorithm?

```
reverse(a):
    for i = 1 to len(a)-1
        x = a[i]
        for j = i downto 1
            a[j] = a[j-1]
        a[0] = x
```

Correct!

- (selected) $O(n^2)$
- $O(n^3)$
- $O(n)$
- $O(n/2)$

Question 9

1 / 1 pts

Which of the following equations correctly represent the factorial function.

Factorial of a number n is given by:

$$Factorial\ of\ n\ =\ n * (n-1) * (n-2) \cdot \cdot \cdot \cdot \cdot \cdot \cdot 3 * 2 * 1$$

- f(n) = n f(n)
- f(n) = (n-1) f(n-1)

Correct!

- (selected) f(n) = n f(n-1)
- f(n-1) = n f(n)

Question 10

1 / 1 pts

Which of the following recurrence relations is correct representation of the towers of Hanoi problem that was discussed in the exploration?

- F(n) = nF(n-1) + 1
- F(n) = 2F(n-1)

Correct!

- (selected) F(n) = 2F(n-1) + 1
- F(n) = F(n-1) + 2

Quiz Score: **10** out of 10