Q1

5 Points

The Fibonacci sequence is defined as 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

The first two terms, f(0) and f(1), are equal to 1. Every subsequent term is the sum of the two previous terms. Thus for each $n \geq 2$, we have $f(n) = f(n-1) + f(n-2)$.

Here are two Python programs to calculate $f(n)$. One of these two methods uses bottom-up dynamic programming and one of these two methods uses recursion. But which one is which?

```
def fib1(n):
    if n<=1: return 1
    else: return fib1(n-1)+fib1(n-2)
```

```
def fib2(n):
    table = [0 for i in range(n+1)]
    for i in range(n+1):
        if i<=1: table[i]=1
        else: table[i]=table[i-1]+table[i-2]
    return table[n]
```

Q1.1 Part a

2 Points

Looking at the program fragment, which of these is based on dynamic programming?

Your answer should be written as: fib1 or fib2

fib2

Q1.2 Part b

1 Point

To help me figure which algorithm is which, I decided to calculate fib1(44) and fib2(44), and was shocked to discover that the running times were so different!

Here are two statements.

fib1(44) ran in 275.69 seconds and fib2(44) ran in 0.000 seconds
fib1(44) ran in 0.000 seconds and fib2(44) ran in 275.69 seconds

Which of these two statements is correct? Answer either A or B.

A

Q1.3

2 Points

For each of our two Fibonacci-calculating algorithms above, we can determine the running time.

Here are six statements

- ○ fib1(n) is $\Theta(n^2)$ and fib2(n) is Θ(n)
- ○ fib1(n) is $\Theta(n^2)$ and fib2(n) is $\Theta(n^2)$
- ◉ fib1(n) is $\Theta(2^n)$ and fib2(n) is Θ(n)
- ○ fib1(n) is $\Theta(2^n)$ and fib2(n) is $\Theta(n^2)$
- ○ fib1(n) is Θ(n!) and fib2(n) is Θ(n)
- ○ fib1(n) is Θ(n!) and fib2(n) is Θ(n2)

Q2

1 Point

Dynamic Programming can be used to solve numerous real-life optimization problems.

Consider these six problems.Five of these six problems have elegant and efficient solutions using Dynamic Programming, but one of these problems does not.

Which of these six problems cannot be solved using Dynamic Programming?

- ( ) `Given a rod, and a set of prices p[i] for each cut of length i, c`
- (•) `Given a rod, and a set of prices p[i] for each cut of length i, c`
- ( ) `Given a graph, determine the shortest path from the start vertex`
- ( ) `Given a graph, determine the longest path from the start vertex t`
- ( ) `Given a sequence of integers, determine the longest increasing su`
- ( ) `Given a sequence of integers, determine the longest decreasing su`

Q3

2 Points

In addition to being a Computer Scientist, you have a (side-hustle) business where you sell flower bouquets.Each of your flower bouquets consists of a certain number of red roses, with a minimum of 1 and a maximum of 6.

This is the profit you make from each of your bouquets, which is a function of the number of red roses in that bouquet.

You have 6 roses with you, and now you need to decide what bouquets to make in order to maximize your profit. I have presented this data as a set of tuples below.

(Roses, Prices) = {(1,\$3),(2,\$5), (3, \$9), (4,\$13), (5,\$14), (6,\$18)}

For example, if you make two 2-rose bouquets and two 1-rose bouquets (2+2+1+1=6), then your profit is 5+5+3+3=16 dollars. Note- for this problem you can have multiple rose bouquets in each category.

However, if you make a 5-rose bouquet and a 1-rose bouquet (5+1=6), then your profit is 14+3=17 dollars.

Determine the maximum profit you can make.

19

Quiz 5-DP

GRADED

STUDENT

Kejian Tong

TOTAL POINTS

7 / 8 pts

QUESTION 1

(no title) **5** / 5 pts

1.1 Part a **2** / 2 pts

1.2 Part b **1** / 1 pt

1.3 (no title) **2** / 2 pts

QUESTION 2

(no title) **0** / 1 pt

QUESTION 3

(no title) **2** / 2 pts