Started on	Thursday, 23 February 2023, 11:34
State	Finished
Completed on	Thursday, 23 February 2023, 18:57
Time taken	7 hours 22 mins
Marks	8.33/16.00
Grade	3.65 out of 7.00 (52%)

Question 1

Correct

Mark 1.00 out of 1.00

Consider Selection Sort: How many times will a given object at most be exchanged (ie. moved around in the array)?

Select one:

- a. $\log(n)$
- b. $n^2/2$
- c. 1
- d. $n-1$ ✓

Your answer is correct.

The correct answer is: $n-1$

Question 2

Incorrect

Mark 0.00 out of 1.00

Consider running Selection Sort on the array E A S Y Q U E S T I O N

After the algorithm has done 2 exchanges, how does the array look?

Select one:

- a. A E E S Y Q U S T I O N
- b. A E E Y Q U S S T I O N ×
- c. A E S Y Q U E S T I O N

Your answer is incorrect.

The correct answer is: **A E S Y Q U E S T I O N**

Question 3

Incorrect

Mark 0.00 out of 1.00

Consider using Top-down Merge Sort on the array a consisting of the keys:

E A S Y Q U E S T I O N.

If the initial call to sort uses the indices sort(a, 0, 11), which indices does the second recursive (not the first recursive) call to sort use as parameters?

Select one:

- a. sort(a, 0, 5)
- b. sort(a, 6, 8)
- c. sort(a, 6, 11) ×
- d. sort(a, 0, 2)

Your answer is incorrect.

The correct answer is: **sort(a, 0, 2)**

Question 4

Correct

Mark 1.00 out of 1.00

Again, consider using Top-down Merge Sort on the array a consisting of the keys:

E A S Y Q U E S T I O N.

Which indices are used as parameters to the second to last call to merge?

Select one:

- a. merge(a, 8, 11, 15)
- b. merge(a, 8, 9, 11)
- c. merge(a, 5, 8, 11)
- d. merge(a, 6, 8, 11) ✓

Your answer is correct.

The correct answer is: **merge(a, 6, 8, 11)**

Question 5

Correct

Mark 1.00 out of 1.00

Imagine an array a of size n presented as a recursion tree while running a top-down merge sort. Each node of the tree represents a sub-array of a (as described in Chapter 2.2 of [SW]) Can you say anything wise about the height h of this tree in relations to n?

Select one:

- a. h is always $n/2$
- b. h is always $\log n$ ✓
- c. h takes an arbitrary value based on the contents of a
- d. h is always $n \log n$

Your answer is correct.

The correct answer is: h is always $\log n$

Question 6

Correct

Mark 1.00 out of 1.00

Define the values $f(n)$ positive integers n by

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

$$f(1) = f(2) = 1$$

Compute $f(6)$

Answer: 8 ✓

The correct answer is: 8

Question 7

Partially correct

Mark 0.50 out of 1.00

For some real number $r > 1$ and integer K_0, consider the following recurrence relation:

$$K(n) = K(n-1) + K(n-1) \cdot r$$

$$K(0) = K_0.$$

Which well-known phenomenon does this recurrence describe and what is the closed form?

Select one or more:

- ☐ a. $K(n)$ is the total capital after n years with interest rate r and starting capital K_0.
- ☐ b. $K(n)$ is the nth Fibonacci number, provided $r = 2$ and $K_0 = 1$.
- ☐ c. $K(n)$ is the total speed of a car with acceleration r after n seconds, starting from K_0.
- ☐ d. $K(n)$ is the number of comparisons for sorting n numbers for an r-recursive algorithm with stack size K_0.
- ☑ e. $K(n) = (1+r)^n K_0$ ✓
- ☐ f. $K(n) = K_0 \log_r n$
- ☐ g. $K(n) = K_0 + nr$
- ☐ h. $K(n) = K_0 + n + r$

Your answer is partially correct.

You have correctly selected 1.

The correct answers are: $K(n)$ is the total capital after n years with interest rate r and starting capital K_0., $K(n) = (1+r)^n K_0$

Question 8

Correct

Mark 1.00 out of 1.00

Solve the following recurrence:

$T(n) = T(n-1) + 3$

$T(0) = 0$.

Select one:

- a. $T(n) = 3n$ ✓
- b. $T(n) = 3 + n$
- c. $T(n) = n^3$
- d. $T(n) = \frac{1}{3}n$

Your answer is correct.

The correct answer is: $T(n) = 3n$

Question 9

Correct

Mark 1.00 out of 1.00

Professor Sloppy wrote down the following recurrence for f_n for integer $n \geq 1$:

$f_n = f_{n-1} + f_{n-2}$

$f_1 = 1$

What are the problems, if any, with this formulation?

Select one or more:

- a. Recurrences must be written as functions ($T(n) = \cdots$, not as sequences $f_n = \cdots$)
- b. You can never have two occurrences of the recursively-defined values (here, f_{n-1} and f_{n-2}) on the right hand side. ✗
- c. The values are undefined because there is only one base case. ✓
- d. Recurrences must be defined for all real numbers, not only integers.

Your answer is correct.

The correct answer is: The values are undefined because there is only one base case.

Question 10

Partially correct

Mark 0.83 out of 5.00

Consider the *lexicographic ordering* on sequences of digits, such as 235. Then the following list is sorted in ascending order: 10 ✓ < 11 ✗ < 48 ✗ < 50 ✗ < 99 ✗ < 100 ✗

Your answer is partially correct.

You have correctly selected 1.

The correct answer is:

Consider the *lexicographic ordering* on sequences of digits, such as 235. Then the following list is sorted in ascending order: [10] < [100] < [11] < [48] < [50] < [99]

Question 11

Correct

Mark 1.00 out of 1.00

Consider the *numeric ordering* on sequences of digits, such as 235, using the standard convention, i.e., $235 = 2 \cdot 10^2 + 3 \cdot 10 + 5$. Then the following list is sorted in ascending order: 10 ✓ < 11 ✓ < 48 ✓ < 50 ✓ < 99 ✓ < 100 ✓

Your answer is correct.

The correct answer is:

Consider the *numeric ordering* on sequences of digits, such as 235, using the standard convention, i.e., $235 = 2 \cdot 10^2 + 3 \cdot 10 + 5$. Then the following list is sorted in ascending order: [10] < [11] < [48] < [50] < [99] < [100]

Question 12

Not answered

Marked out of 1.00

(You probably need to consult an external source for this.)

Three Danish locations, sorted lexicographically according to Danish rules: [ ] < [ ] < [ ] < [ ]

Three Swedish locations, sorted lexicographically according to Swedish rules: [ ] < [ ] < [ ] < [ ]

Three German locations, sorted lexicographically according to German rules: [ ] < [ ] < [ ] < [ ]

Ägyptisches Museum Berlin	Überlingen	Växjö	Århus
Zarrentin am Schaalsee	Ølstykke	Åre	Ærø
Skallebølle	Ängelholm	Öland	Öhringen

Your answer is incorrect.

The correct answer is: (You probably need to consult an external source for this.)

Three Danish locations, sorted lexicographically according to Danish rules: [Skallebølle] < [Ærø] < [Ølstykke] < [Århus]

Three Swedish locations, sorted lexicographically according to Swedish rules: [Växjö] < [Åre] < [Ängelholm] < [Öland]

Three German locations, sorted lexicographically according to German rules: [Ägyptisches Museum Berlin] < [Öhringen] < [Überlingen] < [Zarrentin am Schaalsee]