Started on	Tuesday, 18 October 2022, 5:05 PM
State	Finished
Completed on	Tuesday, 18 October 2022, 5:13 PM
Time taken	7 mins 58 secs
Marks	23.00/29.00
Grade	**7.93** out of 10.00 (**79**%)

Question **1**

Correct

Mark 1.00 out of 1.00

If a, b and c are integers, which of the following statements is/are TRUE?

Note that a | b means b is multiple of a, that is, there is an integer k such that b = ka

(i) If a | bc, then a | b.

(ii) If ab | c, then b | c.

a. Both (i) and (ii)

b. (i) only

c. (ii) only ✔

d. Neither (i) nor (ii)

Question 2

Correct

Mark 1.00 out of 1.00

Find the least integer k such that f(n) is $O(n^k)$
if $f(n) = 7n^3 + n^3 \log n$

- a. 2
- b. 3
- c. 1
- d. 4 ✔

Your answer is correct.
$f(n) = 7n^3 + n^3 \log n$ is $O(n^3 \log n)$
==> k = 4

Question 3

Incorrect

Mark 0.00 out of 1.00

Suppose that a computer has only the memory locations 0, 1, 2, ..., 29. Use the hashing function h where h(x) = (x + 5) mod 30 to determine the memory locations in which 97, 32, and 16 are stored.

- a. 12, 2, 16
- b. 12, 7, 16 ✖
- c. None of the others
- d. 7, 2, 16
- e. 12, 7, 21

Question 4

Correct

Mark 1.00 out of 1.00

Which of the following statements is/are TRUE?

(i) The bubble sort has $O(n^2)$ time complexity.

(ii) The merge sort has O(nlogn) time complexity.

- a. (ii) only
- b. (i) only
- c. Neither (i) nor (ii)
- d. Both (i) and (ii) ✔

Question 5

Correct

Mark 1.00 out of 1.00

Determine the big-oh time complexity of the following algorithm:

```
procedure tt(a1, a2, ..., an: integers)
        count := 0
        v := a1
        for i := 2 to n do
                if ai = v then
                        count := count + 1
                        ai := ai + i
        return (count)
```

- a. O (n)
- b. O(1)
- c. O(logn)

Question **6**

Correct

Mark 1.00 out of 1.00

Give as good a big-O estimate as possible for $(n\log n + n^2)(n^3 + 1)$.

- a. $o(n^2 \log n)$
- b. $O(n^5)$ ✔
- c. $O(n^4 \log n)$
- d. None of these
- e. $O(n^3)$

Your answer is correct.

Question **7**

Correct

Mark 1.00 out of 1.00

Give the "best" big-oh notation to describe the complexity of the algorithm that prints all bit strings of length n.

- a. $O(2^n)$ ✔
- b. $O(n)$
- c. $O(n^2)$
- d. $O(n \log n)$

Question 8

Correct

Mark 1.00 out of 1.00

Convert $(43)_5$ to its decimal expansion.

a. 35
b. 130
c. 103
d. 23 ✔
e. None of the others

4*5 + 3 = 23

Question 9

Incorrect

Mark 0.00 out of 1.00

Which of the following statements is/are TRUE?

(i) 2^n is $O(n^2)$

(ii) 2^n is $O(n^3)$

- a. Both (i) and (ii) ✖
- b. (i) only
- c. (ii) only
- d. Neither (i) nor (ii)

Question **10**

Correct

Mark 1.00 out of 1.00

Find 17 **mod** 5 and -17 **mod** 5.

a. None of the others

b. 3 and -3

c. 2 and 3 ✔

d. 3 and 2

e. 2 and -2

17 = 5.3 **+ 2** ==> 17 mod 5 = 2

-17 = 5(-4) **+ 3** ==> -17 mod 5 = 3

Question 11

Incorrect

Mark 0.00 out of 1.00

Find gcd(2^{30}, 8^{11}).

- a. 8
- b. None of the others
- c. 8^{11}
- d. 2^{30}
- e. $2^{30}.8^{11}$

Question 12

Correct

Mark 1.00 out of 1.00

Give a big-O estimate for the number of additions used in the following algorithm:

```
procedure sum(n: positive integer)
    s := 0
    for i := 1 to n
        for j := 1 to n
            s := s + i + j
```

a. O(2n)

b. $O(n^2)$ ✔

c. O (n)

d. O(logn)

Question **13**

Correct

Mark 1.00 out of 1.00

If $f(x) = (2x + 3)$ **mod** 26 is a good coding function.

- a. *No.* $f(0) = f(13)$, and hence f is not a bijection (no inverse function for decryption) ✔
- b. Yes. f(x) is a bijection and therefore it is a good coding function

Your answer is correct.

Question **14**

Incorrect

Mark 0.00 out of 1.00

If a = -37 mod 7 and b = 37 mod 7, what is the value of a + b?

- a. 4 ✖
- b. 0
- c. 7
- d. None of the others
- e. 2

Question **15**

Correct

Mark 1.00 out of 1.00

Give a big-O estimate for $(x^2 + x\log x)\cdot(2x + 3)$.

- a. $O(x^3)$ ✔
- b. None of the others
- c. $O(x^2)$
- d. $O(x\log x)$
- e. $O(x^2\log x)$

Question **16**

Correct

Mark 1.00 out of 1.00

Encrypt the message VA using the function f (p) = (p + 7) mod 26.

- a. AL
- b. None of the others
- c. CH ✔
- d. DM
- e. BK

Question 17

Correct

Mark 1.00 out of 1.00

Given the bubble sort algorithm.

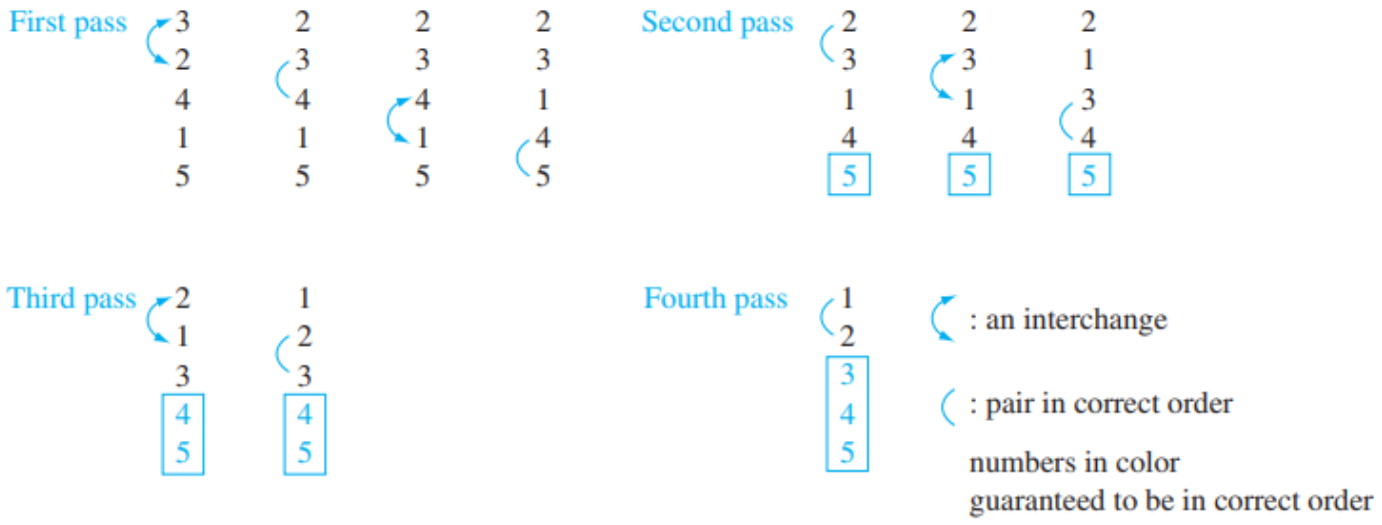
ALGORITHM 4 The Bubble Sort.

procedure *bubblesort*($a_1, \ldots, a_n$: real numbers with $n \geq 2$)
for $i := 1$ **to** $n - 1$
  for $j := 1$ **to** $n - i$
    if $a_j > a_{j+1}$ **then** interchange a_j and a_{j+1}
{$a_1, \ldots, a_n$ is in increasing order}

Use the bubble sort to put 3, 2, 4, 1, 5 into increasing order.
Showing the lists obtained after the second pass (i = 2).

- a. 3, 1, 2, 4, 5
- b. 1, 2, 3, 4, 5
- c. 2, 1, 3, 5, 4
- d. 2, 1, 3, 4, 5 ✔
- e. None of these

Your answer is correct.



Question **18**

Correct

Mark 1.00 out of 1.00

The password for a quiz was encrypted using the function f(p) = (p + 5) mod 26. If the result is "GZ", find the quiz password.

a. TV

b. BT

c. None of the others

d. CV

e. BU ✔

Question 19

Correct

Mark 1.00 out of 1.00

Find the best big-oh function for the function
$f(n) = 1 + 4 + 7 + ... + (3n + 1)$.

a. O(n)

b. $O(n^2)$

c. $O(n^3)$

d. O(1)

Your answer is correct.

Question 20

Incorrect

Mark 0.00 out of 1.00

Give the best big-oh estimate for the function

f(n) = $1^2 + 2^2 + 3^2 + \ldots + n^2$

- a. $O(n^3)$
- b. $O(n^2 \log n)$ ✖
- c. None of these
- d. $O(n^4)$
- e. $O(n^2)$

Your answer is incorrect.

Question 21

Correct

Mark 1.00 out of 1.00

How many positive integers less than 5 are **relatively prime** to 5?

- a. 1
- b. 3
- c. 2
- d. 5
- e. 4 ✔

Question 22

Correct

Mark 1.00 out of 1.00

A sequence of pseudo-random numbers are generated using $x_{n+1} = (3x_n + 5) \bmod 31$ with seed $x_0 = 2$.
Find x_1, x_2, and x_3.

- a. $x_1 = 11, x_2 = 7, x_3 = 13$
- b. None of the others
- c. $x_1 = 8, x_2 = 29, x_3 = 30$
- d. $x_1 = 11, x_2 = 1, x_3 = 8$
- e. $x_1 = 11, x_2 = 7, x_3 = 26$ ✔

Question 23

Correct

Mark 1.00 out of 1.00

A pseudorandom sequence $\{x_n\}$ is generated by:

$x_0 = 1$, $x_{n+1} = (3x_n + 5) \bmod 17$ if $n \geq 0$.
Find x_0, x_1, x_2, x_3.

- a. 1, 8, 12, 7 ✔
- b. None of the others
- c. 1, 8, 10, 12
- d. 8, 12, 7, 9
- e. 12, 7, 9, 15

Question 24

Correct

Mark 1.00 out of 1.00

Find the integer x such that $5x \equiv 1 \pmod{13}$ and $0 \leq x \leq 12$.

- a. 3
- b. None of the others
- c. 5
- d. 7
- e. 8 ✔

Question 25

Correct

Mark 1.00 out of 1.00

Which of the following statements is/are TRUE:

(i) $9n^2 + 9n + 99$ is $O(n^2)$

(ii) nlogn is O(n)

- a. (i) only ✔
- b. Both (i) and (ii)
- c. (ii) only
- d. Neither (i) nor (ii)

Question 26

Correct

Mark 1.00 out of 1.00

Convert 19 to a base 3 expansion.

a. $(61)_3$

b. $(21)_3$

c. $(201)_3$ ✔

d. None of the others

e. $(102)_3$

Question 27

Correct

Mark 1.00 out of 1.00

Given the Euclidean algorithm.

ALGORITHM 1 The Euclidean Algorithm.

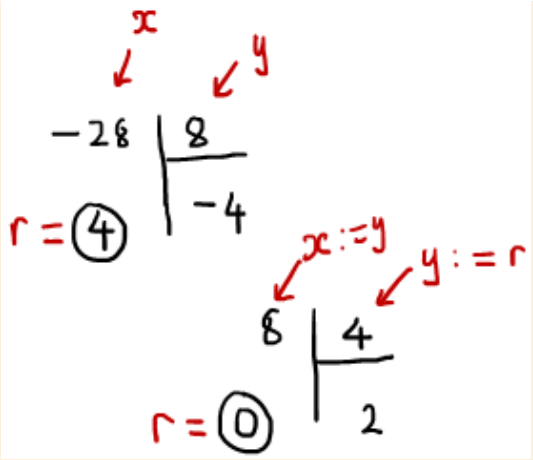
procedure $gcd(a, b$: positive integers)
$x := a$
$y := b$
while $y \neq 0$
    $r := x$ **mod** y
    $x := y$
    $y := r$
return $x\{\text{gcd}(a, b)$ is $x\}$

Use the Euclidean algorithm to find gcd(28, 8).

How many **divisions** are required?

- a. 2
- b. 3
- c. 5
- d. 4
- e. None of these

Your answer is correct.



Question 28

Incorrect

Mark 0.00 out of 1.00

Find the best big-O function for $\sum_{j=1}^{n} (j^3 + j)$

a. $O(n^4)$

b. $O(n)$

c. $O(n^3)$

d. $O(n^2)$

Your answer is incorrect.

Question 29

Correct

Mark 1.00 out of 1.00

If a and b are two distinct primes, the ab^2 has ___ positive divisors.

- a. 6
- b. 5
- c. 2
- d. 4
- e. 3