

Indian Statistical Institute

BSDS, First Year, Mid-Sem of First Semester Examination, 2024-25
Introduction to Computing

Full Marks: 30

Date: 04-10-2024

Time: 2 Hours

Answer any *three* of the following questions

$3 \times 10 = 30$

1. Prove or disprove the following statements:

- (a) The operation $n = n \wedge (1 \ll p)$ will toggle (flip) the bit in the position p of the integer n .
- (b) The Boolean expression $(A \text{ and } (A \text{ or } B)) \text{ and } (\text{not } A)$ gets always evaluated as False.
- (c) The binary number $[xy] \dots 3k$ times is always divisible by 7, where x and y are any arbitrary bit (0 or 1).
- (d) The operation $(b \wedge (a \wedge b) \& \sim(a < b))$ will return the minimum of the pair of integers a and b .
- (e) The operation $(a \wedge (a \wedge b) \& \sim(a < b))$ will return the maximum of the pair integers a and b .

2+2+2+2+2

2. Match the following two sides of statements (in python) with proper justifications. Note that there is no necessary one-to-one correspondence between the two sides.

Side A	Side B
$n = \sim n$	$n = n - 1$
$n = (n \gg 3) + (n \gg 1)$	$n = n + 1$
$n = \text{sum}([n \text{ for } i \text{ in range}(n)])$	$n = n * 10$
$n = \text{sum}([n \text{ for } i \text{ in range}(m)])$	$n = n * m$
$n = \sim -n$	$n = n ** 2$

2+2+2+2+2

3. (a) The following incomplete Python program aims to check whether a number is even or odd. Complete it by filling up the blank portion and justify your answer.

```
def checkEvenOdd(n):  
    if n _____ 1:  
        print (n, 'is odd')  
    else:  
        print (n, 'is even')  
  
n = 11  
checkEvenOdd(n)
```

(b) The following incomplete Python program aims to print the natural inverse bitonic sequence, which is a sequence of numbers starting from n first strictly decreasing up to 0 and then strictly increasing up to n , for a given n . For example, for $n = 5$, the output

will be as follows.

5 4 3 2 1 0 1 2 3 4 5

Complete it by filling up the blank portion and justify your answer.

```
def inverseBitonic(n):
    print(n, end = " ")
    if n == 0:
        return
    else:
        _____
        print(n, end = " ")
        return

n = 5
inverseBitonic(n)
```

(c) The following incomplete Python program aims to flatten a nested list. For example, the following list

```
[[1, 2], [3], [4, 5, 6], [7, 8, 9, 10]]
```

will be flattened as the list

```
[1, 2, 3, 4, 5, 6, 7, 8, 9, 10].
```

Complete it by filling up the blank portion and justify your answer.

```
ls = [[1, 2], [3], [4, 5, 6], [7, 8, 9, 10]]
flattened_list = []
for sublist in ls:
    for n in sublist:
        _____

print (flattened_list)
```

2+4+4

4. (a) Recall that an integer is spy number if the sum of its digits equals the product of its digits. For example, 1124 is a spy number. Prepare a *flowchart* to verify whether a given integer is a spy number or not. For an example, consider the following sample I/O.

Sample Input:

1124

Sample Output:

1124 is a spy number

(b) Write a *pseudocode* to take a list of distinct integers as input and count the number of increasing pairs within it. Two elements $L[i]$ and $L[j]$ of a list L are said to form an increasing pair if $L[i] > L[j]$ for $i > j$. For an example, consider the following sample I/O.

Sample Input:

8 1 2 4

Sample Output:

3

Note that the increasing pairs in the list are (1, 2), (1, 4) and (2, 4).

4+6