# Thank you for taking the Week 3 : Assignment 3.



## Week 3 : Assignment 3

**Your last recorded submission was on 2022-02-15, 22:47 IST Due date: 2022-02-16, 23:59 IST.**

There are N people who have to go to Paris, but the travel agency wants to use only a minimum number of boats. Each boat can carry up to only a certain weight W. The travel agency also knows the weight of all N people. Also only two people can fit in a boat.

1) Given N = 4, W = 10, if the weights of the passengers are 8 2 3 10. How many boats will the travel agency use?

3

***1 point***

unit=32&lesson=36)
Assessment submitted.
X
When Greedy Does Not Work - Coin Change (unit? unit=32&lesson=37)
When Greedy Does Not Work - Guarding a Museum (unit? unit=32&lesson=38)
When Greedy Does Not Work - Traveling Salesman (unit? unit=32&lesson=39)
Week 3 Feedback Form: Getting Started with Competitive Programming (unit? unit=32&lesson=40)
**Quiz: Week 3 : Assignment 3 (assessment? name=144)**
Practice: Week 3: Practice Assignment 3(Non Graded) (assessment? name=145)
Week 3 Programming Assignment: Book Heist (/noc22_cs59/progassignment? name=146)
Week 3 Programming Assignment: Fixing Gadgets (/noc22_cs59/progassignment? name=134)

2) Consider the algorithm given below to solve the problem: ***1 point***

```
N := Number of passengers
W := Weight capacity of boat
A := Array containing the weights of the passengers

TotalWeight := 0

for i := 0 to N-1
    TotalWeight := TotalWeight + A[i]

# Ceil (num) := Returns the least succeeding integer of num
# For Example: Ceil(1.2) = 2, Ceil(3) = 3, Ceil(4.6) = 5

Answer = Ceil (TotalWeight / W)
# Answer := Minimum number of boats the travel agency should use
```

Choose the correct option:

- [ ] The algorithm returns correct output on all given inputs where $N > 0, W > 0$ and $A[i] > 0$ for all $i \geq 0$
- [x] The answer returned by the algorithm will be less than optimal answer for some inputs
- [ ] The answer returned by the algorithm will be greater than the optimal answer for some inputs
- [x] The algorithm always returns the answer which is less than or equal to the optimal answer
- [ ] The algorithm always returns the answer which is greater than or equal to the optimal answer

3) Given N = 20, W = 15, if the weights of the passengers are
9 8 8 9 10 8 5 8 7 10 6 7 7 6 8 9 9 11 7 5.
How many boats will the travel agency use?

12

***1 point***

There are $N$ students standing in a line. You want to distribute books to each of them. You are given an array $A$ of length $N$, where $A[i]$ indicates the standard in which the $i^{th}$ student in the line is studying. Each student should receive at least one book. And the students who are studying in higher standard than their neighbouring students must receive more books than their neighbouring students. Here, neighbouring students means the just next and previous student in the line. You want the total number of books to be distributed as minimum as possible. Based on these information answer the following questions:

4) For the given array $A$ = [3, 5, 6, 3, 2, 1, 2, 2, 3, 1], what will be the minimum number of total books that you will have to distribute?

19

***1 point***

Assessment submitted.
X



5) Consider the below algorithm implemented for the above described question: (assume zero indexing, i.e. the index of the $1^{st}$ element of the array is 0) ***1 point***

**Algorithm:**

```
function MinBooks (A):
    # Books := Array of length N denoting ith student received B[i] books
    Books := [1, 1, ...., 1]

    for i = 1 to N-1:
        if A[i] > A[i-1] := Books[i] = Books[i-1] + 1

    # sum(Books) returns the sum of each element of the array Book
    total := sum(Books)

    return total

A := Given array of length N
Ans := MinBooks (A)
```

Which of the following option(s) are correct?

- [ ] The algorithm gives correct answer on every input array
- [x] The number of books returned by this algorithm may not be sufficient to distribute to the students as per the conditions given in the question
- [ ] The number of books returned by this algorithm can be more than the number of required books as per the conditions given in the question
- [ ] The algorithm gives correct answer if the given array A follows this property: for all $i, j \geq 0$, if $i < j$, then $A[i] \geq A[j]$.

6) Consider the below updated algorithm: (assume zero indexing, i.e. the index of the $1^{st}$ element of the array is 0) ***1 point***

```
function MinBooks (A):
    # Books := Array of length N denoting ith student received B[i] books
    Books := [1, 1, ...., 1]

    for i = 1 to N-1:
        if A[i] > A[i-1] := Books[i] = Books[i-1] + 1

    # Newly added part
    for j = N-2 to 0:
        if (condition) := do this

    # sum(Books) returns the sum of each element of the array Book
    total := sum(Books)
    return total

A := Given array of length N
Ans := MinBooks (A)
```

Choose the correct option to replace “condition” and “do this” so that this updated algorithm

Assessment submitted.
X

returns the correct answer.

- ○ condition: $A[j+1] > A[j]$ and Books$[j+1]$ ≤ Books$[j]$, do this: Books$[j]$ = Books $[j+1]+1$
- ○ condition: $A[j] > A[j+1]$ or Books$[j] \leq$ Books$[j+1]$, do this: Books$[j]$ = Books $[j+1]+1$
- ◉ condition: $A[j] > A[j+1]$ and Books$[j] \leq$ Books$[j+1]$, do this: Books$[j]$ = Books $[j+1]+1$
- ○ condition: $A[j] > A[j+1]$ and Books$[j] \leq$ Books$[j+1]$, do this: Books$[j]$ = Books $[j-1]+1$

Consider two arrays $A$ and $B$ with $m$ and $n$ elements respectively. Given an integer $k$, what is the maximum number (with atmost $k$ digits) that can be created using digits from arrays $A$, $B$. For example:

```
A = [4,3,2,1]
B = [9,1,2,8,9]
k = 4

result = [9,9,8,4]
```

The maximum 4 digit number one can get is 9984. $Constraints: 1 \leq A_i, B_i \leq 9, k \leq m+n$

7) Approach 1: Concatenate A and B to form array C. Find k largest digits. Return the digits in descending order in an array. Does this approach work? What is the worst-case time complexity of the algorithm? (consider we are finding maximums using brute force without sorting, and deletion takes $O(1)$ in our data structure) ***1 point***

- ☑ Yes
- ☐ No, not for all arrays.
- ☐ $\mathcal{O}(klog(m+n))$
- ☐ $\mathcal{O}(mn)$
- ☑ $\mathcal{O}(k(m+n))$

8) Now consider that you have to maintain the relative ordering of elements in the array. Hence, the answer to the fore-mentioned example is now: [9,8,9,4] or 9894. Does the above ***1 point***

Assessment submitted.
X

mentioned algorithm work for this modification of problem?

- ○ Yes
- ◉ No

You are given a number $S$.

9) You have to represent $S$ as the sum of $N$ distinct positive integers such that $N$ is maximum then which of the following is true? ***1 point***

- ☐ For a given $S$ the maximum value of $N$ is the smallest $j$ for which $\Delta(j) \geq S$ where $\Delta(j) = \sum_{i=1}^{j} i$.
- ☑ For a given $S$ the maximum value of $N$ is the greatest $j$ for which $\Delta(j) \leq S$ where $\Delta(j) = \sum_{i=1}^{j} i$
- ☑ if $S = 70$ then maximum value of $N$ is 11.
- ☐ if $S = 70$ then maximum value of $N$ is 12.

10) You have to represent S as the sum of N distinct positive even integers such that N is maximum then which of the following is true? ***1 point***

- ☐ For a given $S$ the maximum value of $N$ is the smallest $j$ for which $\Delta(j) \geq \frac{S}{2}$ where $\Delta(j) = \sum_{i=1}^{j} i$.
- ☑ For a given $S$ the maximum value of $N$ is the greatest $j$ for which $\Delta(j) \leq \frac{S}{2}$ where $\Delta(j) = \sum_{i=1}^{j} i$
- ☐ if $S = 69$ then maximum value of $N$ is 7.
- ☑ if $S = 70$ then maximum value of $N$ is 7.

You may submit any number of times before the due date. The final submission will be considered for grading.

**Submit Answers**