Lab Worksheet 6 Solution: Functions

CS 101 Algorithmic Problem Solving

Fall 2023

Name(s): _____

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1. Restaurant Employees

Ali is a restaurant manager who wants to print a receipt that shows the total amount to be paid to his employee based on the hourly wage. Every employee gets paid 200 rupees per hour. Receipt shall show the employee's name and the amount received.

Write a function called WageCalculator that takes hours h as its argument and returns the total amount to be paid. Any hours worked above 40 are not paid. Print the receipt as the final output.

Constraints

- $h \in \mathbb{N}$
- $1 \leq h \leq 40$

Interaction

The input comprises a single line containing name N of the employee and the number of hours h the employee has worked.

The output must show a line stating the name and the amount to be paid.

Sample

Input	Output
Fakhar 30	Fakhar is paid 6000 rupees.
Amna 50	Amna is paid 8000 rupees.

In the first case, total hours are 30 so total amount is 30 * 200 = 6000. Function returns this amount and is used when printing the receipt.

In the second case, total hours are 50 but only 40 will be considered payable. Hence, the total amount to be paid is 40 * 200 = 8000. This value returned by function is used to issue the receipt.

Exercise

In the space provided, indicate the outputs for the given inputs.

Input	Output
Fatima 45	Fatima is paid 8000 rupees.
Zain 15	Zain is paid 3000 rupees.
Asiya 29	Asiya is paid 5800 rupees.

Problem Identification
Briefly explain the underlying problem you identified in the above question that led you to your solution.

Answer: Wage as an output needs to be calculated using h as input. Condition needs to be checked to calculate wage only for h lesser than or equal to 40.

Input: (N, h)
Output: Call the function, WageCalculator with h as argument

Inside Function: If h is less than 40, then returned output is h * 200; Otherwise, it returns 40*200 = 8000

After coming back from function, the output is printed in the desired format

Pseudocode
After defining the function, make sure to call it and print its result. You may assume that input has already been taken.

```
#Function Definition
def WageCalculator(h):
  wage = 0
  if h > 40:
    wage = 40 * 200
  else:
    wage = h * 200
  return wage

#Function call
print(N,"is paid", WageCalculator(h), "rupees.")
```

Dry Run
Using any two of the inputs provided in the Exercise section above, dry run your pseudocode in the space below.

Input: $(N, h) = (\text{“}Fatima\text{”}, 45)$

N	h	wage
Fatima	45	40*200 = 8000
return 8000		

Result statement is printed after function returns with value = 8000, which is the expected output

Input: $(N, h) = (\text{“}Zain\text{”}, 15)$

N	h	wage
Zain	15	15*200 = 3000
return 3000		

Result statement is printed after function returns with value = 3000, which is the expected output

This means the applied logic is correct

2. Highest Score and the Reward

Sara's parents buy her a present based on the maximum score she gets in the 3 courses she is currently taking. However, if the maximum score is lesser than 70 or any of her scores are lesser than 50, Sara does not receive any gift at all.

Write a function CalculateMax that takes 3 inputs x, y, z and returns the maximum of the three. Use the value returned from the function to decide whether she receives a present or not. Print the maximum score when she receives a present.

Constraints

- $0 \leq x, y, z \leq 100$
- Do **NOT** use built-in function(s) to calculate the maximum

Interaction

The input comprises a single line containing 3 space-separated integers denoting the values of x, y and z respectively.

The output must contain a single stating whether she receives a present or not.

Sample

Input	Output
98 77 60	Sara will get a present based on the maximum score 98.
69 55 61	Sara will not get a present.

In the first case, the maximum of the three is 98, which is greater than or equal to 70; and all the three scores are greater than or equal to 50 therefore, she'll receive a present.

In the second case, the maximum of the three is 69 which is lesser than 70 therefore, she won't be receiving any present.

Exercise

In the space provided, indicate the outputs for the given inputs.

Input	Output
45 92 66	Sara will not get a present.
78 88 95	Sara will get a present based on the maximum score 95
66 69 54	Sara will not get a present.

Problem Identification
Briefly explain the underlying problem you identified in the above question that led you to your solution.

Answer: We need to find the maximum using conditions and then use the maximum and more conditions to check all scores are above 50 to decide whether she gets a present or not.

Input: (x, y, z)
Output: Call the function, CalculateMax with x, y, z as arguments

Inside Function: Find maximum of x, y and z and return the maximum value

After coming back from function, check the conditions for getting the present, and print the output statement accordingly

Pseudocode

```
#Function Definition
def CalculateMax(x, y, z):
    maximum = 0
    if x >= y and x >= z:
        maximum = x
    elif y >= z and y >= x:
        maximum = y
    else:
        maximum = z
    return maximum

#Function Call
score = CalculateMax(x, y, x)

if x > 50 and y > 50 and z > 50 and score > 70:
    print("Sara will get a present based on the maximum score", score)
else:
    print("Sara will not get a present.")
```

Dry Run
Using any two of the inputs provided in the Exercise section above, dry run your psuedocode in the space below.

Input: $(x, y, z) = (45, 92, 66)$

x	y	z	maximum
45	92	66	92
return 92			

Result statement is printed after function returns, that is "Sara will not get a present.", which is the expected output

Input: $(x, y, z) = (45, 92, 66)$

x	y	z	maximum
78	88	95	95
return 95			

Result statement is printed after function returns, that is "Sara will get a present based on the maximum score 95", which is the expected output

This means the applied logic is correct

3. Desibucks

Hassan is in charge of printing the names of the customers on their coffee cups. Customers write their names on a sheet which he then uses to print on a cup. However, some customers write their names in lowercase, some uppercase and some just use both. In order to have some uniformity, Hassan develops a system where if the order is placed after the sunset he prints the name in uppercase else in lowercase.

Write a function MyName that takes the name N and time of order T (hours) as arguments and prints the name accordingly.

Hint: Python has the built-in functions upper() and lower(). Moreover, the sun sets at 19 where Hassan lives.

Constraints

- $1 \leq T \leq 24$

Interaction

The input comprises a single line containing a string and an integer denoting the values of N and T respectively.

The output must contain a single line stating the appropriate name.

Sample

Input	Output
waQar 20	WAQAR
FatIMA 12	fatima

In the first case, the order is placed after the sunset as $20 > 19$, therefore the name is printed in all uppercase.

In the second case, the order is placed before the sunset as $17 < 19$, therefore the name is printed in all lowercase.

Exercise

In the space provided, indicate the outputs for the given inputs.

Input	Output
AHMED 22	AHMED
kaRIm 19	karim
uShNa 10	ushna

Problem Identification
Briefly explain the underlying problem you identified in the above question that led you to your solution.

Answer: This question uses condition and 2 built-in functions to print the names accordingly.

Input: N, T
Output: Call the function, MyName with N and T as arguments

Inside Function: Name is printed in uppercase letters, if $T > 19$; otherwise, it is in lowercase letters

Pseudocode

```
#Function Definition
def MyName(N, T):
  if T > 19:
    print(N.upper())
  else:
    print(N.lower())

#Function Call
MyName(N, T)
```

Dry Run
Using any two of the inputs provided in the Exercise section above, dry run your pseudocode in the space below.

Input: $(N, T) = (\text{“}AHMED\text{”}, 22)$

N	T	Output
AHMED	22	AHMED
Does not return anything as it is void function, but prints AHMED		

Result statement is correctly printed

Input: $(N, T) = (\text{“}kaRIm\text{”}, 19)$

N	T	Output
kaRIm	19	karim
Does not return anything as it is void function, but prints karim		

Result statement is correctly printed

This means the applied logic is correct

4. Best Choice laptop

Ali decided to buy a new laptop. His budget is B, so he cannot buy a laptop whose price is greater than B. Other than that, he only has one criterion — the area of the laptop's screen should be as large as possible. Of course, the screen of a laptop is always a rectangle.

Ali has visited some laptop shops and listed all of his options. In total, there are N available laptops. Write a main function *BestChoice* that takes N and B as arguments and prints the area of the laptop that is best suited for Ali else prints "No laptop" if none is best suited. It takes N number of inputs where each input has length l, width w and the price p. Use a helper function *AreaCalculator* that calculates the area of the laptop's screen and the value returned shall be used by the main function to decide the best choice.

Constraints

- $1 \leq N \leq 4$
- $1 \leq B, p, l, w \leq 100$

Interaction

The first line of input contains two space-separated integers N and B. N lines follow, each containing 3 space separated integers denoting the values of l, w and p respectively.

The output must contain a single number denoting the area of the best choice laptop.

Sample

Input	Output
3 6 3 4 4 5 5 7 5 2 5 2 6 3 6 8 5 4 9	12

In the first case, The first laptop (with screen area 3 * 4 = 12) is the best option for Ali, since Ali cannot afford the second one and the third one has a smaller screen.

In the second case, Ali's budget is 6, but all laptops have higher prices, so Ali cannot buy any laptop.

Exercise

In the space provided, indicate the outputs for the given inputs.

Input	Output
2 8 3 8 8 5 5 6 3 15 2 6 16 3 6 19 5 4 33	25 No laptop

Problem Identification
Briefly explain the underlying problem you identified in the above question that led you to your solution.

Answer: First we need to check the price and then use the areas to compare and find the maximum.

Input: $N, b, l1, w1, p1, l2, w2, p2, ..., lN, wN, pN$
Output: Call the base function, BestChoice with N and B as arguments

Inside BestChoice Function: For N times, take 3 inputs, i.e. l, w and p
Then call a helper function, AreaCalculator with l and w as arguments to calculate and return the area.

Once back to BestChoice function, select the maximum area based on the given conditions, and print it if the conditions are satisfied; otherwise, print "No output"

Pseudocode

```
#Function Definition
def AreaCalculator(l, w):
  area = l * w
  return area

def BestChoice(N, B):
  maximum = 0
  for i in range(N):
    l = int(input())
    w = int(input())
    p = int(input())
    areaBestChoice = AreaCalculator(l, w)
    if p <= B and areaBestChoice > maximum:
      maximum = areaBestChoice
  if maximum > 0:
    print(maximum)
  else:
    print("No laptop")

#Function Call
BestChoice(N, B)
```

Dry Run
Using any two of the inputs provided in the Exercise section above, dry run your pseudocode in the space below.

Input: $(N, B, (l1, w2, p2), (l2, w2, p2)) = (2, 8, (3, 8, 8), (5, 5, 6))$

N	B	i	l	w	p	areaBestChoice	maximum
2	8	0	3	8	8	3*8 = 24	24
		1	5	5	6	5*5 = 25	25
Does not return anything as it is void function, but prints 25							

Result statement is correctly printed

Input: $(N, B, (l1, w2, p2), (l2, w2, p2), (l3, w3, p3)) = (3, 15, (2, 6, 16), (3, 6, 19), (5, 4, 33))$

N	B	i	l	w	p	areaBestChoice	maximum
3	15	0	2	6	16	2*6 = 12	0
		1	3	6	19	3*6 = 18	0
		2	5	4	33	5*4 = 20	0
No p is less than B, so it does not return anything, and prints "No laptop"							

Result statement is correctly printed

This means the applied logic is correct

LET'S LEARN TO DEBUG

5. Bun-Kabab and Luck

Shahid has a Bun-Kabab stall that gets many orders everyday. But he is very superstitious. He believes if cost of even number of orders is special then he will be lucky to have the most profitable 2 days. Cost of an order is special if it is a multiple of 5 and is greater than 100.

Write a function LuckyOrNot that checks whether Shahid will be having 2 profitable days or not. Function takes an integer n indicating the total number of orders. Take cost of each order as input inside this function. Then use a helper function SpecialCost that takes cost c as a parameter and checks its specialty.

Constraints

- $1 \leq n \leq 100$
- $50 \leq c \leq 2000$

Interaction

The input comprises an integer that indicates the value of n followed by n number of lines each denoting the cost of an order.

The output must a line indicating whether Shahid will be lucky or not.

Sample

Input	Output
4	Shahid will not have profitable days in near future.
51	
50	
90	
86	
3	Shahid will be lucky to have profitable days in near future.
140	
205	
95	

In the first case, though 2 of the orders' costs are a multiple of 5 but they both are lesser than 100 so none of the orders were special hence, Shahid will not be lucky.

In the second case, 140 and 205 are both special cost orders. So the total number of special orders are even therefore, Shahid will be lucky.

Proposed Solution

```
#Function Definition
def SpecialCost(c):
  if (cost > 100) and (cost % 5 == 0):
    print(True)

#Function Definition
def LuckyOrNot(n):
  orders = 0
  for i in range(n):
    c = int(input())
    if SpecialCost() != False:
      orders += 1
  if (orders % 2 == 0 and orders!=0):
    print("Shahid will be lucky to have profitable days in near future.")
  else:
    print("Shahid will not have profitable days in near future.")

#Function Call
LuckyOrNot(n)
```

Dry Run

Using any two of the inputs provided in the Sample section above, dry run the proposed pseudocode in the space below.

Input: $(n, (c1, c2, c3, c4)) = (4, (51, 50, 90, 86))$

n	i	c	order	calling SpecialCost function	SpecialCost Function
4	0	51	0	Function being called without argument	
				Correct syntax to call: SpecialCost(51)	Incorrect Argument
					Correct syntax and execute
					Does nothing and ends
			0	Condition not satisfied	
	1	50	0	Function being called without argument	
				Correct syntax to call: SpecialCost(50)	Incorrect Argument
					Correct syntax and execute
					Does nothing and ends
			0	Condition not satisfied	
	2	90	0	Function being called without argument	
				Correct syntax to call: SpecialCost(90)	Incorrect Argument
					Correct syntax and execute
					Does nothing and ends
			0	Condition not satisfied	
	3	86	0	Function being called without argument	
				Correct syntax to call: SpecialCost(86)	Incorrect Argument
					Correct syntax and execute
					Does nothing and ends
			0	Condition not satisfied	

Order is 0 so it prints the output, "Shahid will not have profitable days in near future.", which is the expected output

Input: $(n, c1, c2, c3) = (3, 140, 205, 95)$

n	i	c	order	calling SpecialCost function	SpecialCost Function
3	0	140	0	Function being called without argument	
				Correct syntax to call: SpecialCost(140)	Incorrect Argument
					Correct syntax and execute
					prints True but returns nothing
			0	Condition not satisfied	
	1	205	0	Function being called without argument	
				Correct syntax to call: SpecialCost(205)	Incorrect Argument
					Correct syntax and execute
					prints True but returns nothing
			0	Condition not satisfied	
	2	95	0	Function being called without argument	
				Correct syntax to call: SpecialCost(95)	Incorrect Argument
					Correct syntax and execute
					Does nothing and ends
			0	Condition not satisfied	

Order is 0 so it prints the output, "Shahid will not have profitable days in near future.", which is not the expected output

Incorrect outputs, so need to correct the logic!

Error Identification
Briefly explain the errors you identified in the proposed code solution. Mention the line number and errors in each line.

Answer:
Line number 2, we need to write cost instead of c else function won't be able to identify cost.
Line number 4, we need to return not print because by printing it will give none type. Moreover, we need to return false in the else case.
Line 11 we need to provide the argument as well.

Correct Solution

Rewrite the lines of code you mentioned above with their errors corrected.

```
#Function Definition
def SpecialCost(cost):
  if (cost > 100) and (cost % 5 == 0):
    return (True)
  else:
    return False

#Function Definition
def LuckyOrNot(n):
  orders = 0
  for i in range(n):
    c = int(input())
    if SpecialCost(c) != False:
      orders += 1
  if (orders % 2 == 0 and orders!=0):
    print("Shahid will be lucky to have profitable days in near future.")
  else:
    print("Shahid will not have profitable days in near future.")

#Function Call
LuckyOrNot(n)
```

6. Time to Vote

Election season has started in Pakistan and the election commission wants to know the count of eligible voters. Mohammad has been assigned to count the number of eligible voters, who are atleast above age X.

Make a function that takes N and X as arguments, then takes age as input N times. The function shall return the total number of eligible voters.

Constraints

- $1 \leq N, X \leq 100$

Interaction

The input comprises a single line containing 2 space-separated integers denoting the values of N and X respectively. It is then followed by N inputs denoting the age of each voter.

The output must contain a single number denoting the total number of eligible voters.

Sample

Input	Output
4 6	3
8 9 2 12	
5 4	2
2 2 3 4 8	

In the first case, only three voters are older than 6 therefore, only 3 are eligible to vote.

In the second case, only 2 people are 4 or older than that hence they the output is 2.

Proposed Solution

```
#Function Definition
def EligibleVoters(N):
  for i in range(N):
    age = int(input())
    if age >= X:
      voters+=1
  return(voters)

#Function Call
EligibleVoters(N)
```

Dry Run

Using any two of the inputs provided in the Sample section above, dry run the proposed pseudocode in the space below.

Input: $(N, X, (age1, age2, age3, age4)) = (4, 6, (8, 9, 2, 12))$

N	i	age	X	voters
4	0	8	Does not exist inside the function	
			Correct function header to have X as argument as well	
			After updating syntax, X = 6	Variable does not exist
				Initialize it to 0 outside loop first
				After initialization, voters = 1
	1	9	6	2
	2	2	6	2
	3	12	6	3

No output is printed because function was called with incorrect arguments. Once the syntax was corrected, there was no print statement to print the output

Incorrect output, so need to correct the logic!

Error Identification

Briefly explain the errors you identified in the proposed code solution. Mention the line number and errors in each line. Will the function print the required output?

Answer:

Function is defined with incorrect number of arguments. We also need to give X for function to use it for later use else it will not be able to identify the X that we have used later.
We also need to initialize voters with 0 for the function to recognize it when iterating.
When we are calling the function, we need to pass both N and X as arguments
Moreover, there should be a print before function call else nothing will be output to the screen.

Correct Solution

Rewrite the lines of code you mentioned above with their errors corrected.

```
#Function Definition
def EligibleVoters(N, X):
  voters=0
  for i in range(N):
    age = int(input())
    if age >= X:
      voters+=1
  return(voters)

#Function Call
print(EligibleVoters(N,X))
```

Rough Work