# Lab Worksheet 2 Solution: Conditionals

CS 101 Algorithmic Problem Solving

Fall 2023

Name(s): _____

HU ID *(e.g., xy01042)*: _____



## 1. Candies Fight

There are three friends and a total of $N$ candies. There will be a fight amongst the friends if all of them do not get the same number of candies.

Chef wants to divide all the candies such that there is no fight. Find whether such distribution is possible.

**Constraints**

- $1 \leq N \leq 100$

**Interaction**

The input comprises a single line containing an integer denoting the value of $N$.

The output must be a Yes or No, depending on whether the candies can be evenly distributed or not.

**Sample**

| Input | Output |
|---|---|
| 3 | Yes |
| 4 | No |

In the first case, Chef can distribute all 3 candies such that each friend gets 1 candy. Since all three friends have same number of candies, there is no fight.

In the second case, There exist no way of distributing all candies such that all three friends have same number of candies.

**Exercise**

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

| Input | Output |
|---|---|
| 2 | No |
| 6 | Yes |
| 123 | Yes |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**
Briefly explain the underlying problem you identified in the above question that led you to your solution.
**Answer:**There will be no fight if the number of candies N is a multiple of 3 which means it is completely divisible by 3, this way all the candies will be equally distributed.

Input: $N$
Output: "YES" if N% 3 == 0, else "NO"

## 2. Seige Truck

Arpasland is surrounded by attackers. A truck enters the city. The driver claims the load is food and medicine from Iranians. Ali is one of the soldiers in Arpasland. He doubts about the truck, maybe it's from the siege. He knows that a tag is valid if the sum of every two consecutive digits of it is even.

Determine if the tag of the truck is valid or not.

**Constraints**

- Tag can not contain more than 5 digits.

**Interaction**

The input comprises a single line containing a 5 digits number representing the tag.

The output must be a Valid or Non-Valid depending on the validity of the tag based on the condition mentioned above.

**Sample**

| Input | Output |
|---|---|
| 12446 | Invalid |
| 35119 | Valid |

In the first case, sum of the first and second digit is odd hence, it is invalid.

In the second case, sum of all the consecutive digits is even although the digits are odd hence it is a valid tag.

**Exercise**

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

| Input | Output |
|---|---|
| 24311 | Invalid |
| 64088 | Valid |
| 97316 | Invalid |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**
Briefly explain the underlying problem you identified in the above question that led you to your solution.
**Answer:**We just need to add every 2 consecutive digits and see if their sum is completely divisible by 2 or not. If there is no remainder when the sum is divided by 2 then it means it is an even number and if all sums are even then it is a valid tag.

Input: *Tag*
Output:
**Sum of last two digits (digits 4 and 5)***
Sum1 = Tag % 10
Tag = Tag//10
Sum1 = Sum1 + Tag % 10

**Sum of digits 3 and 4***
Sum2 = Tag % 10
Tag = Tag//10
Sum2 = Sum2 + Tag % 10

**Sum of digits 2 and 3***
Sum3 = Tag % 10
Tag = Tag//10
Sum3 = Sum3 + Tag % 10

**Sum of first two digits (digits 1 and 2)***
Sum4 = Tag % 10
Tag = Tag//10
Sum4 = Sum4 + Tag % 10

"Invalid" if (Sum1 % 2 != 0 or Sum2 % 2 != 0 or Sum3 % 2 != 0 or Sum4 % 2 != 0), else "Valid"

## 3. Favorite Numbers

Alice likes numbers which are even, and are a multiple of 7. Bob likes numbers which are odd, and are a multiple of 9. Alice, Bob, and Charlie find a number $A$.

- If Alice likes $A$, Alice takes home the number.
- If Bob likes $A$, Bob takes home the number.
- If both Alice and Bob don't like the number, Charlie takes it home.

Given $A$, find who takes it home.

**Constraints**

- $1 \leq A \leq 1000$

**Interaction**

The input comprises a single line containing an integer denoting the value of $A$.

The output must contain the name of the person who takes $A$ home. Name shall be as the following: Alice, Bob or Charlie.

**Sample**

| Input | Output |
|---|---|
| 7 | Charlie |
| 27 | Bob |

In the first case, 7 is not even, hence Alice doesn't like it. It is odd, but isn't a multiple of 9. Hence Bob doesn't like it. Therefore, Charlie takes it home.

In the second case, 27 is odd and a multiple of 9. Therefore, Bob likes it and takes it home.

**Exercise**

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

| Input | Output |
|---|---|
| 14 | Alice |
| 21 | Charlie |
| 63 | Bob |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**

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

**Answer:**This is a simple question where we need to check if the number is even (i.e. no remainder when divided by 2) and a multiple of 7 (i.e. no remainder when divided by 7). If this is the case, then Alice takes home the number. Else if the number is odd (i.e. when divided by 2, the remainder is non-zero or 1) and a multiple of 9 (i.e. no remainder when divided by 9), then Bob takes home the number. Otherwise, if none of the above conditions are satisfied, the number is given to Charlie instead.

Input: $A$
Output:
"Alice" if (A % 2 == 0 and A % 7 == 0),
"Bob" if (A % 2 != 0 and A % 9 == 0),
else "Charlie"

## 4. Football Match

Chef is watching a football match. The current score is $A : B$, that is, team 1 has scored $A$ goals and team 2 has scored $B$ goals. Chef wonders if it is possible for the score to become $C : D$ at a later point in the game (i.e. team 1 has scored $C$ goals and team 2 has scored $D$ goals).

Can you help Chef by answering his question?

**Constraints**

- $0 \leq A, B, C, D \leq 100$

**Interaction**

The input comprises a single line containing 4 space-separated integers denoting the values of $A, B, C$ and $D$ respectively.

The output shall state if the given score transitioning is Possible or Impossible.

**Sample**

| Input | Output |
|---|---|
| 1 5 3 5 | Possible |
| 3 4 2 6 | Impossible |

In the first case, The current score is 1:5. If team 1 scores 2 more goals, the score will become 3:5. Thus 3:5 is a possible score.

In the second case, The current score is 3:4. It can be proven that no non-negative pair of integers $(x, y)$ exists such that if team 1 scores $x$ more goals and team 2 scores $y$ more goals the score becomes 2:6 from 3:4. Thus in this case 2:6 is an impossible score.

**Exercise**

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

| Input | Output |
|---|---|
| 2 2 2 2 | Possible |
| 0 1 8 0 | Impossible |
| 9 9 7 13 | Impossible |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**

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

**Answer:** In this we need to subtract A from C and B from D, if the answer of any subtraction comes out to be negative then it is not possible because the score can not decrease.

Input: $A, B, C, D$
Output:
"Impossible" if ($C < A$ or $D < B$ ),
else "Possible"

## 5. Car Choice

Chef is planning to buy a new car for his birthday. After a long search, he is left with 2 choices:

- Car 1: Runs on diesel with a fuel economy of $x_1$ km/l.
- Car 2: Runs on petrol with a fuel economy of $x_2$ km/l.

Chef also knows that:

- the current price of diesel is $y_1$ rupees per litre.
- the current price of petrol is $y_2$ rupees per litre.

**Constraints**

- $1 \leq x_1, x_2, y_1, y_2 \leq 50$

**Interaction**

The input comprises a single line containing 4 space-separated integers denoting the values of $x_1, x_2, y_1$ and $y_2$ respectively.

The output must contain 1 if car 1 is a better choice, 2 if car 2 is a better choice and 0 if both cars will result in the same expenses.

**Sample**

| Input | Output |
|---|---|
| 10 5 3 20 | 1 |
| 7 2 7 2 | 0 |

In the first case, The cost of driving Car 1 is 3/10 = 0.3 rs/km, and the cost of driving Car 2 is 20/5 = 4 rs/km. Therefore, Car 1 is cheaper to drive, so the output is 1.

In the second case, The cost of driving Car 1 is 1 rs/km, and the cost of driving Car 2 is also 1 rs/km. Both cars offer the same economy, so the output is 0.

**Exercise**

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

| Input | Output |
|---|---|
| 1 5 3 2 | 2 |
| 3 3 6 12 | 1 |
| 4 2 16 8 | 0 |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**

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

**Answer:**We need to find rs/km to find the better choice which will be the one with lesser rs/km. We can find that by dividing y by x, for each car, and the one with smaller value will be considered as the final answer.

Input: $x_1$, $x_2$, $y_1$, $y_2$
Output:
1 if $(y_1/x_1 < y_2/x_2)$,
2 if $(y_1/x_1 > y_2/x_2)$,
else 0

## 6. Rooks Attack

You are given a standard 8×8 chessboard which has exactly 2 rooks on it and no other pieces. The rows are numbered 1 to 8 from bottom to top, and the columns are numbered 1 to 8 from left to right. The cell at the intersection of the $i$-th column and $j$-th row is denoted $(i, j)$.

Given the initial positions of the rooks in the form of coordinates $(x_1, y_1)$ and $(x_2, y_2)$. you need to tell whether the 2 rooks currently attack each other or not. Assume, each square can contain at most one piece.

Hint: Rooks can only travel in straight lines along the row or column they are placed at, and can't jump over other pieces.

**Constraints**

- $1 \leq x_1, x_2, y_1, y_2 \leq 8$
- $(x_1, y_1) \neq (x_2, y_2)$

**Interaction**

The input comprises a single line containing 4 space-separated integers denoting the values of $x_1, y_1, x_2$ and $y_2$ respectively.

The output must contain a single line stating Yes if the rooks attack each other, and No otherwise.

**Sample**

| Input | Output |
|---|---|
| 1 2 5 2 | Yes |
| 1 1 8 8 | No |

In the first case, The two rooks can attack each other by moving along the second column.

In the second case, No matter how a rook moves it cannot reach the second rook in one move. Hence, they do not attack each other.

**Exercise**

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

| Input | Output |
|---|---|
| 1 2 1 5 | Yes |
| 2 4 4 8 | No |
| 3 3 4 3 | Yes |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**
Briefly explain the underlying problem you identified in the above question that led you to your solution.
**Answer:**We just need to compare the x and y coordinates of both the players, if either x coordinates or y coordinates are the same, then it means rooks attack each other.

Input: $x_1$, $y_1$, $x_2$, $y_2$
Output:
"Yes" if ($x_1 == x_2$ or $y_1 == y_2$),
else "No"

## 7. Tax Money

In Chefland, a tax of rupees 10 is deducted if the total income is strictly greater than rupees 100.

Given that total income is $X$ rupees, find out how much money you get.

**Constraints**

- $X \in \mathbb{N}$

**Interaction**

The input comprises a single line containing an integer denoting the value of $X$.

The output must contain a single number denoting the amount of money you get.

**Sample**

| Input | Output |
|---|---|
| 5 | 5 |
| 105 | 95 |

In the first case, Your total income is 5 rupees which is less than 100 rupees. Thus, no tax would be deducted and you get 5 rupees.

In the second case, Your total income is 105 rupees which is greater than 100 rupees. Thus, a tax of 10 rupees would be deducted and you get 105 - 10 = 95 rupees.

**Exercise**

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

| Input | Output |
|---|---|
| 99 | 99 |
| 101 | 91 |
| 125 | 115 |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**
Briefly explain the underlying problem you identified in the above question that led you to

your solution.
**Answer:**We simply need to check if the income is greater than or equal to 100 and if it is, then subtract 10 from it. Otherwise the income remains the same as the input.

Input: $X$
Output: $X$ if X $<$ 100, else X - 10

## 8. Grading

HackerLand University has the following grading policy:

- Every student receives a grade in the inclusive range from 0 to 100.
- Any grade less than 40 is a failing grade.

Sam is a professor at the university and likes to round each student's grades according to these rules:

- If the difference between the grade and the next multiple of 5 is less than 3, round grade up to the next multiple of 5.
- If the value of grade is less than 38, no rounding occurs as the result will still be a failing grade.

Given the grade $g$ of Sam's student, find out the final grade after rounding as per his rules.

**Constraints**

- $0 \leq g \leq 100$

**Interaction**

The input comprises a single line containing an integer denoting the value of $g$.

The output must contain a single number denoting final grade after rounding.

**Sample**

| Input | Output |
|---|---|
| 84 | 85 |
| 57 | 57 |

In the first case, $g = 84$ and the next multiple of 5 is 85, 85 - 84 = 1 which is lesser than 3. Therefore, it is rounded to the next multiple of 5 which is 85.

In the second case, $g = 57$ and the next multiple of 5 is 60, 60 - 57 = 3 which is not lesser than 3. Therefore, it is is not rounded and remains as is.

**Exercise**

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

| Input | Output |
|---|---|
| 29 | 29 |
| 78 | 80 |
| 51 | 51 |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**

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

**Answer:**We need to first check if the grade is in the passing range, i.e. it is greater than or equal to 38. If it is then find the next multiple of 5 for which we can use the formula: ((number // 5) * 5) + 5. Then simply subtract the multiple from g. If the difference is less than 3 we can round it up to the next multiple, which is already calculated in the first step. Otherwise, the output will be the same as the grade, i.e. g

Input: $g$
Output:
g if $g < 38$,
((g//5 * 5) + 5) if (g - ((g//5 * 5) + 5)) < 3),
else g

## 9. Book Pages

A teacher asks the class to open their books to a page number. A student can either start turning pages from the front of the book or from the back of the book. They always turn pages one at a time. When they open the book, page 1 is always on the right side.

When they flip page 1, they see pages 2 and 3. Each page except the last page will always be printed on both sides. The last page may only be printed on the front, given the length of the book.

If the book is $n$ pages long, and a student wants to turn to page $p$, what is the minimum number of pages to turn? They can start at the beginning or the end of the book.

**Constraints**

- $1 \leq n \leq 1000$
- $1 \leq p \leq n$

**Interaction**

The input comprises a single line containing 2 space-separated integers denoting the values of $n$ and $p$ respectively.

The output must contain a single number denoting the minimum number of pages to turn.

**Sample**

| Input | Output |
|---|---|
| 5 3 | 1 |
| 5 4 | 0 |

In the first case, if the student wants to get to page 3, they open the book to page 1, flip 1 page and they are on the correct page. If they open the book to the last page, page 5, they turn 1 page and are at the correct page. So the minimum in both cases is 1.

In the second case, rather than staring from the first page we start from page 5. Both 4 and 5 are printed on each side so there is no need to turn any pages hence, the answer is 0.

**Exercise**

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

| Input | Output |
|---|---|
| 6 2 | 1 |
| 19 12 | 3 |
| 50 42 | 4 |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**

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

**Answer:**We need to find out the total number of pages needed to be turned from the front and the back of the book. For the front we can simply do (p // 2) because book has pages printed on both sides. For the back we need to do subtraction like (n//2 - p//2). Whichever is lower we return that.

Input: $n, p$
Output:
Front = p//2,
Back = (n//2 - p//2),
Output is min(Front, Back)

## 10. Game Winner

Nitin and Sobhagya were playing a game with coins. If Sobhagya has more coins then he is winning, otherwise Nitin is winning. Note that this means if both Nitin and Sobhagya have the same number of coins, then Nitin is winning.

Initially Nitin has $A$ coins while Sobhagya has $B$ coins. Then Ritik came and gave his $C$ coins to the player who is not winning currently, after which Satyarth came and repeated the same process (gave his $D$ coins to the player who is not winning currently).

Find the final winner of the game.

**Constraints**

- $1 \leq A, B, C, D \leq 1000$

**Interaction**

The input comprises a single line containing 4 space-separated integers denoting the values of $A, B, C$ and $D$ respectively.

The output shall be S if Sobhgaya is the final winner and N if Nitin is the final winner.

**Sample**

| Input | Output |
|---|---|
| 2 3 4 5 | S |
| 3 3 3 3 | N |

In the first case, Initially, Nitin has 2 coins and Sobhagya has 3 coins, so Sobhagya is winning. Then, Ritik gives his 4 coins to Nitin. Now Nitin has 6 coins and Sobhagya has 3 coins, so Nitin is winning. Then, Satyarth gives his 5 coins to Sobhagya. Finally Nitin has 6 coins and Sobhagya has 8 coins, so Sobhagya is the final winner.

In the second case, initially, Nitin has 3 coins and Sobhagya has 3 coins, so Nitin is winning. Then, Ritik gives his 3 coins to Sobhagya. Now Nitin has 3 coins and Sobhagya has 6 coins, so Sobhagya is winning. Then, Satyarth gives his 3 coins to Nitin. Finally Nitin has 6 coins and Sobhagya has 6 coins, so Nitin is the final winner.

**Exercise**

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

| Input | Output |
|---|---|
| 2 3 1 2 | S |
| 4 3 2 2 | N |
| 6 7 8 1 | N |

**Propose**

Provide sample inputs and outputs below. Do not reuse any of the values from above.

| Input | Output |
|---|---|
| | |
| | |
| | |

**Problem Identification**

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

**Answer:**We first need to compare A and B, the add C coins to whoever is not winning. Do that again for D coins. At the end check the sums and declare the winner.

Input: $A, B, C, D$
Output:
A = A + C if A < B,
else B = B + C

B = B + D if B <= A,
else A = A + D

Output is max(A, B)