Seminar Worksheet 2: Conditionals

CS 101 Algorithmic Problem Solving

Fall 2023 — Week 2

Name(s): _____

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

1. Bill or a Phone number?

In Meowland, a valid phone number consists of 5 digits with no leading zeros.

For example, 98765, 10000, 71023 are valid numbers while 04123 and 9231 are not.

Chef went to a store and purchased N items, where the cost of each item is X.

Given N and X, find whether the total bill is equivalent to a valid phone number.

Constraints

- $N, X \in \mathbb{N}$
- $1 \leq N, X \leq 1000$

Interaction

The input comprises a single line containing 2 space-separated integers denoting the values of N and X respectively.

The output must contain a string containing either YES, if the total bill is equivalent to a valid phone number and NO otherwise.

Sample

Input	Output
25 785	YES
402 11	NO

In the first case, $(N, X) = (25, 785)$. Chef bought 25 items, each with cost 785. The total bill is thus $25 * 785 = 19625$. This is a valid phone number and the output is "YES".

In the second case, $(N, X) = (402, 11)$. Chef bought 402 items that cost 11 each. The total bill is thus $402 * 11 = 4422$. This is not a valid phone number and the output is "NO".

Exercise

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

Input	Output
100 100	YES
33 12	NO
130 120	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.

Input: N, X
Output: "YES" if $10000 \leq N * X \leq 99999$ else "NO"

2. Figuring out the salary

After consultation with your financial advisor, you have devised the following payment scheme at your startup. An employee's *gross salary* is the sum of their basic salary, HRA, and DA. If the basic salary is less than \$1500, then HRA = 10% of the basic salary and DA = 90% of the basic salary. Otherwise, HRA = \$500 and DA = 98% of the basic salary.

Given S, the basic salary of an employee, as input, output their gross salary.

Constraints

- $S \in \mathbb{N}$
- $1 \leq S \leq 100000$

Interaction

The input comprises a single line containing containing the value of S.

The output must contain a single number upto 2 decimal places denoting the gross salary of the employee.

Sample

Input	Output
1203	2406.00
10042	20383.16

In the first case, $S = 1203$. The value of S is less than 1500 therefore, $HRA = 10\% = 120.3$, and $DA = 90\% = 1082.7$. Therefore the gross salary $= 1203 + 120.3 + 1082.7 = 2406.00$

In the second case, $S = 10042$. The value of S is greater than 1500 therefore, $HRA = RS.500$, and $DA = 98\% = 9841.16$. Therefore the gross salary $= 10042 + 500 + 9841.16 = 20383.16$

Exercise

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

Input	Output
1312	2624.00
2300	5054.00
1899	4260.02

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.

Input: S
Output: $2S$ if $S < 1500$ else $500 + 1.98S$

3. Where am I?

Chef is visiting Hunza and trying to find her way on the map. She is currently facing North. Each minute she turns exactly 90° in the clockwise direction.

There are only 4 directions: North, East, South, West (in clockwise order) and Chef wants to know the direction she will be facing after X minutes.

Given X, find the direction in which Chef is facing after exactly X minutes.

Constraints

- $X \in \mathbb{N}$
- $1 \leq X \leq 1000$

Interaction

The input contains a single line containing a single integer denoting the value of X.

The output must contain a single string—"North", "East", "South", or "West"—indicating the direction in which chef is facing after X minutes.

Sample

Input	Output
1	East
6	South

In the first case, $X = 1$. In 1 minute, Chef turns 90° clockwise once and ends up facing East.

In the second case, $X = 6$. In 6 minutes, Chef turns 90° clockwise 6 times, and ends up facing South.

Exercise

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

Input	Output
8	North
15	West
253	East

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.

Input: X
Output: Let R be the remainder of $\frac{X}{4}$. Output "North" if R is 0 else "East" if R is 1 else "South" if R is 2 else "West" if R is 3.

4. To concert or not?

Four friends want to attend a concert and have a combined budget of Rs. 10,000. They will attend the concert only if the total cost is within the budget.

Given X, the cost of each ticket, determine whether they will attend the concert.

Constraints

- $X \in \mathbb{N}$
- $1 \leq X \leq 10000$

Interaction

The input contains a single line containing a single integer denoting the value of X.

The output must contain a single string containing "YES" if they will attend the concert, and "NO" otherwise.

Sample

Input	Output
1000	YES
5000	NO

In the first case, $X = 1000$. Four tickets would cost $100 \times 4 = 4000$. The amount is within the budget and the friends will attend the concert.

In the second case, $X = 5000$. Four tickets would cost $5000 \times 4 = 20000$. The amount is not within the budget and the friends will not miss the concert.

Exercise

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

Input	Output
2500	YES
3680	NO
8900	NO

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.

Input: X
Output: "YES" if $X \leq 2500$ else "NO"

5. Fitness Fun

In order to promote physical fitness, Liebling University is holding a trek along trails of length 100 km, 210 km and 420km. Students who complete any trek within D days will win a prize of amount A, B, and C respectively $(A < B < C)$. There can be multiple winners for a trek and a student can participate in only one trek.

Given the distance $d$km that Chef can cover in a single day, find the maximum prize that she can win at the end of D days.

Constraints

- $d, D, A, B, C \in \mathbb{N}$
- $1 \leq D \leq 25$
- $1 \leq d \leq 50$
- $1 \leq A < B < C \leq 100000$

Interaction

The input contains a single line containing five space-separated integers D, d, A, B, C.

The output must contain an integer indicating the maximum prize that Chef can win. The output must be 0 if no prize can be won.

Sample

Input	Output
10 5 100 200 300	0
20 15 15000 20000 30000	20000

In the first case, $(D, d, A, B, C) = (10, 5, 100, 200, 300)$. The distance covered by Chef in 10 days is $10 \times 5 = 50km$ which is less than any of the available distance categories. Hence Chef won't be able to claim any prize.

In the second case, $(D, d, A, B, C) = (20, 14, 15000, 20000, 30000)$. The distance covered by Chef in 20 days is $20 \times 15 = 3000km$ which satisfies the first and second treks but not the third. Hence Chef can claim a maximum prize of 20000.

Exercise

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

Input	Output
10 9 1100 2400 3600	0
10 20 2000 3000 4000	2000
15 25 2000 3000 4000	3000

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.

Input: D, d, A, B, C
Output: C if $D \times d \geq 420$ else B if $D \times d \geq 210$ else C if $D \times d \geq 100$ else 0

6. Vaccination Dates

Chef took the first dose of vaccine D days ago. The second dose must be taken no less than L days and no more than R days after the first dose.

Given D, L and R, determine if Chef is too early, too late, or in the correct range for taking the second dose.

Constraints

- $D, L, R \in \mathbb{N}$
- $1 \leq D \leq 10^9$
- $1 \leq L \leq R \leq 10^9$

Interaction

The input contains a single line containing the space-separated integers indicating the values of $D, L, R.$ respectively.

The output must contain a string—"Too Early" if it's too early to take the vaccine, "Too Late" if it's too late to take the vaccine, or "Take second dose now" if it's the correct time to take the vaccine.

Sample

Input	Output
8 8 12	Take second dose now
14 2 10	Too Late

In the first case, $(D, L, R) = (8, 8, 12)$. The second dose needs to be taken within 8 to 12 days. Day 8 lies in this range, Chef can take the second dose now.

In the second case, $(D, L, R) = (14, 2, 10)$. The second dose needs to be taken within 2 to 10 days. Day 14 lies after this range, it is too late now.

Exercise

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

Input	Output
4444 5555 6666	Too Early
8 10 12	Too Early
9 2 21	Take second dose now

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.

> Input: D, L, R
> Output: "Too Early" if $D < L$ else "Take second dose now" if $L \leq D \leq R$ else "Too Late"

7. Penalty Shots

In a football tournament, the final match has reached the penalty stage. Each team is given 5 shots at the goal and the team that scores a goal on the most number of shots wins the game. If both the teams' scores an equal number of goals, then the game is considered a draw and there will be 2 champions.

We are given ten integers $A, B, C, D, E, F, G, H, I, J$ where A, C, E, G, I values represent the goals of the first team and B, D, F, H, J values represent the goals of team 2. A value of 1 indicates that a goal was scored and a value of 0 indicates that a goal was not scored.

Determine the winner or find if the game ends in a draw.

Constraints

- $A, B, C, D, E, F, G, H, I, J \in \{0, 1\}$

Interaction

The input contains a single line containing 10 space-separated integers indicating the values of $A, B, C, D, E, F, G, H, I, J$.

The output must contain a single integer - 0 if the game ends in a draw, 1 if the first team wins, or 2 if the second team wins.

Sample

Input	Output
0 0 0 0 0 0 0 0 0 0	0
0 0 0 0 0 0 0 0 0 1	2

In the first case, $(A, B, C, D, E, F, G, H, I, J) = (0, 0, 0, 0, 0, 0, 0, 0, 0, 0)$. No team scores any goal, so the game ends in a draw and 0 is the output.

In the second case, $(A, B, C, D, E, F, G, H, I, J) = (0, 0, 0, 0, 0, 0, 0, 0, 0, 1)$. The second team is able to score in their final shot, while the first team has scored no goals and hence the second team wins and 2 is the output.

Exercise

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

Input	Output
1 0 1 0 0 0 0 0 0 0	1
1 1 1 1 1 1 1 1 1 0	1
1 1 0 1 0 1 0 1 1 0	2

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.

Input: $A, B, C, D, E, F, G, H, I, J$
Output: Let $S1 = A + C + E + G + I$ and $S2 = B + D + F + H + J$. The output is 1 if $S1 > S2$ else 2 if $S1 < S2$ else 0.

8. Vacation

You finally get the time to go on a vacation after a tough semester. You have planned for two trips during this vacation—one with your family and the second with your friends.

The family trip will take X days and the trip with friends will take Y days.Currently, the dates are not decided but the vacation will last only for Z days.

You can only be in at most one trip at any time and once a trip is started, you must complete it before the vacation ends. Planning and packing are already done and will not take time.

Given X, Y, and Z, you want to see if you will you be able to go on both the trips?

Constraints

- $X, Y, Z \in \mathbb{N}$
- $1 \leq X, Y, Z \leq 1000$

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 string—"YES" if you can go on both the trips and "NO" if not.

Sample

Input	Output
1 2 3	YES
2 2 3	NO

In the first case, $(X, Y, Z) = (1, 2, 3)$. The total duration of the trips is $1 + 2 = 3$ days which fits within the vacation days. You can go on both the trips.

In the second case, $(X, Y, Z) = (2, 2, 3)$. The total duration of the trips is $2 + 2 = 4$ days which exceeds the vacation days. You cannot go on both the trips.

Exercise

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

Input	Output
3 6 12	YES
2 2 4	YES
3 8 9	NO

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.

> Input: X, Y, Z
> Output: "NO" if $X + Y > Z$ else "YES"

9. Gold Digger

On a vacation with N friends, Chef stumbled upon a gold mine and dug it all up. The total amount of gold is X kg. Every person has the capacity of carrying up *at most* Y kg of gold. Note that including Chef, there are a total of $(N + 1)$ people.

Given N, X and Y, will Chef and her friends be able to carry all the gold from the gold mine in a single go?

Constraints

- $N, X, Y \in \mathbb{N}$
- $1 \leq N, X, Y \leq 1000$

Interaction

The input comprises a single line containing 3 space-separated integers denoting the values of N, X and Y respectively.

The output must contain a single string—"YES" if the gold can be carried in a single go, or "NO" if it cannot.

Sample

Input	Output
2 10 3	NO
2 10 4	YES

In the first case, $(N, X, Y) = (2, 10, 3)$. There are 3 people in total, each person can carry at most 3kg. The maximum amount of gold that can be carried is $3 \times 3 = 9$kg, which is insufficient.

In the second case, $(N, X, Y) = (2, 10, 4)$. There are 3 people in total, each person can carry at most 4kg. The maximum amount of gold that can be carried is $3 \times 4 = 12$kg, which is sufficient to carry all the gold in a single go.

Exercise

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

Input	Output
4 25 6	YES
3 18 3	NO
1 9 4	NO

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.

Input: N, X, Y
Output: "NO" if $(N+1) * Y < X$ else "YES"

10. Car Choice

Your class has come together to gift Chef a new car for her birthday. After a long search, you are 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.

You also know the current prices of petrol and diesel.

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

You are going to choose the car based on the price of driving each car, assuming that the price of fuel remains the same?

Constraints

- $x_1, x_2, y_1, y_2 \in \mathbb{N}$
- $1 \leq x_1, x_2 \leq 50$
- $1 \leq y_1, y_2 \leq 500$

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 a single line containing -1 if the choice is Car 1, 0 if both cars are equally god choices, or 1 if the choice is Car 2.

Sample

Input	Output
10 5 3 20	-1
1 5 3 2	1

In the first case, $(x_1, x_2, y_1, y_2) = (10, 5, 3, 20)$. The cost per km with Car 1 is $\frac{3}{10} = 0.3$, and with Car 2 is $\frac{20}{5} = 4$. The choice is Car 1 and the output is -1.

In the second case, $(x_1, x_2, y_1, y_2) = (1, 5, 3, 2)$. The cost per km with Car 1 is 3, and with Car 2 is $\frac{2}{5} = 0.4$. The choice is Car 2 and the output is 1.

Exercise

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

Input	Output
7 2 7 2	0
10 3 5 12	-1
12 3 2 9	-1

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.

Input: x_1, x_2, y_1, y_2
Output: Let $c_1 = \frac{y_1}{x_1}, c_2 = \frac{y_2}{x_2}$. Then the output is -1 if $c_1 < c_2$ else 1 if $c_1 > c_2$ else 0.

Rough Work