

Assignment #3 – Good Health

Part 1 Due Monday, April 29th 2024 at Midnight

Part 2 Due Monday, May 6th 2024 at Midnight

Assignment Overview and Outcomes

The focus of this project is on how to solve simple problems using primitive data types, variables, if statements, and arithmetic operations. In this project, you will...

- Develop code to read data from the standard input and produce data to the standard output.
- Translate a given mathematical expression into equivalent syntactically correct programming statements.
- Write code that conforms to a programming style specified by the instructor.
- Select and implement the appropriate control structure(s) for this problem.

As you write your code, be sure to properly document your code. Consult the Class Coding Guidelines document (provided by the instructor) for style expectations. Well-written code is easier to debug, easier to maintain over time, and easier to extend as new requirements arise.

Sustainability Motivation

The United Nations (UN) has set forth 17 goals for [sustainable development](#). Goal 3 is designed to “Ensure healthy lives and promote well-being for all at all ages.” Well-being has many different facets – physiological, psychological, and others – but all require access to resources, including medicine, education, clean water, healthy food, and education. Many parts of the world still suffer from an abundance of treatable diseases and premature mortality. One aspect of well-being involves heart health, which includes related concerns like cholesterol, blood pressure, and respiratory conditions.



In this project, we will consider heart health, blood pressure, and how to measure risk factors for potentially fatal conditions.

Heart Health Background

Heart health is a critical component of a sustainable and enjoyable human life. The human heart pumps and circulates blood throughout the body, so maintaining open and clear pathways (e.g. arteries) is essential to proper health. Cholesterol is one compound that can impede the body's circulatory function. Cholesterol is found in all cells of the body, but an excess of cholesterol can have damaging effects on heart health. Individuals can maintain a healthy cholesterol level by eating a fiber-rich, low-fat diet and getting plenty of exercise,

among other things. Unhealthy cholesterol levels can lead to a variety of heart-related ailments, including arteriosclerosis.

High cholesterol can lead to high blood pressure, which raises your risk of strokes or heart disease. Watch the following video to learn more about how blood pressure works in the body:

<https://www.youtube.com/watch?v=Ab9OZsDECZw>

According to the CDC, about 1 in 3 Americans have high blood pressure. Individuals can maintain a reduce their risk of high blood pressure by eating a healthy diet, getting plenty of exercise, and avoiding tobacco, among other things.

Diagnosing Blood Pressure Problems

While each of us has had a reading of our blood pressure taken, many of us may not know what blood pressure actually means. Blood pressure is expressed as a ratio of the maximum (systolic) and minimum (diastolic) pressure found in the aorta during one cardiac cycle. These pressure values are measured in millimeters of mercury (mmHg). The following link shows an animation of the cardiac cycle, which can help with visualizing these concepts: [Cardiac Cycle \(University of Utah Medical School\)](#)

Determining abnormal blood pressure is critical for diagnosing and averting a number of serious health problems (e.g. heart disease and stroke). Doctors therefore make decisions about the potential for serious health problems based on a few simple calculations. Two simple calculations of interest are pulse pressure (PP) and mean arterial pressure (MAP).

The pulse pressure (PP) of an individual can be computed as the difference between the systolic and diastolic pressures (SP - DP). The mean arterial pressure (MAP) is the average pressure during the cardiac cycle. The MAP of a normal, resting heart can be computed by the formula:

$$MAP = DP + (1/3) * PP$$

- The systolic and diastolic pressures (SP and DP) are measured as positive integer values.
- If the pulse pressure (PP) is greater than 80 mmHg, then inform the user that their pulse pressure is high. If the pulse pressure is 80 mmHG or lower, then inform the user that their pulse pressure is normal.
- If the mean arterial pressure (MAP) is below 60 mmHg, alert the user that they should seek medical assistance. If the mean arterial pressure is 60 mmHg or greater, inform the user that their mean arterial pressure is within acceptable limits.

Program to Write

In this project, you will create a program that will compute a user's pulse pressure (PP) and the mean arterial pressure (MAP) based on two inputs: the systolic pressure (SP) and the diastolic pressure (DP).

- First, create a function that returns a good positive integer from the user.

- Then, create a function that takes the systolic pressure (SP) and the diastolic pressure (DP) as inputs, calculate the pulse pressure (PP) as the difference between the systolic pressure (SP) and the diastolic pressure (DP), i.e. $SP - DP$, and outputs the pulse pressure.
- Then, create a void function that takes the pulse pressure (PP) as input, checks the pulse pressure, and outputs a message to the screen about the PP being high or normal.
- Next, create another function that takes the pulse pressure (PP) and diastolic pressure (DP) as inputs to compute the mean arterial pressure (MAP) using the previously provided formula. Output the mean arterial pressure to the screen.
- Lastly, create a function to determine whether the mean arterial pressure reading is acceptable.

Be sure to include units in your output, and do not use global variables or you will be deducted 10 points. At the end of the document are a few examples to check if your program is working correctly.

Part 1: Program Design

First, you will begin by going through Polya's problem-solving steps. Use the Polya template provided to assist with this step.

Understanding the Problem. (5 pts)

- Do you understand everything in the problem? List anything you do not fully understand.
- What are the functional requirements of the program, i.e. what does it need to do?
- What assumptions are you making?
- What are the inputs, outputs, etc.?

Devise a Plan. (15 pts)

- What are the decisions that need to be made in this program?
- What are the sequence of steps you need to complete?
- How are you going to calculate the pulse pressure and mean arterial pressure?
- What happens when the pulse pressure is too high and the mean arterial pressure is too low?
- How are you going to handle bad input?

Based on your answers above, **provide the algorithm as pseudocode or provide a flowchart** of the specific steps that are needed to create this program, including the error checking. Be very explicit!!!

Looking Back. (5 pts)

Create a test plan with the test cases (bad, good, and edge cases).

- What are the good, bad, and edge cases for ALL input in the program?

- What do you hope to be the expected results?
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Part 2: Write a C++ Program

After your design, you will write the program to get good systolic pressure (SP) and the diastolic pressure (DP) values, calculates the pulse pressure and mean arterial pressure, prints the appropriate values and messages about the person's PP and MAP. You can run your program with examples below to make sure the program works correctly.

Carry out the plan. (75 pts)

(60 pts) Write the program that takes the systolic pressure (SP) and the diastolic pressure (DP) and calculates the pulse pressure (PP) and mean arterial pressure (MAP) by creating and using the five functions specified above.

(15 pts) Remember, you will be graded on having the proper spacing, comments/function descriptions, and good variable/function names, as well as good, clear prompts and output messages.

Here are few sample tests you can run to check if your program is working correctly.

Normal Blood Pressure Example

Enter your systolic pressure: 120
Enter your diastolic pressure: 80
Your pulse pressure is normal: 40.00 mmHG
Your mean arterial pressure is: 93.33 mmHG
Your mean arterial pressure is within acceptable limits.

High Pulse Pressure Example

Enter your systolic pressure: 170
Enter your diastolic pressure: 80
Your pulse pressure is high: 90 mmHG
Your mean arterial pressure is: 110.00 mmHG
Your mean arterial pressure is within acceptable limits.

Low Mean Arterial Pressure Example

Enter your systolic pressure: 80
Enter your diastolic pressure: 40
Your pulse pressure is: 40.00 mmHG
Your mean arterial pressure is: 53.33 mmHG
You should seek medical assistance.