Exam2 - Part 2

CST 237, Computer Architecture, Spring 2022

READ INSTRUCTIONS CAREFULLY BEFORE YOU START THE TEST.

Part two of the exam is take-home. The deadline for submitting your exam to Canvas is May 4th, 2022, 11:59 PM. However, the submission will stay open till May 5th (Thursday), 2021, 11:59 AM for late submission (with a 3% penalty).

In part two of Exam 2, you are assigned the following problems to be completed using MIPS assembly language. Your program must execute to get a grade. There will be no partial credit for code that does not execute.

Part 2 of the exam is worth 40 points and has 3 problems. You are required to complete all problems. You are not supposed to work with anyone else on these problems. This must be your individual work. **Your code will be subject to a plagiarism check. If plagiarism is detected, you may receive an F on the course.**

Your code must be well documented (describe your step in English). Your program code must have a comment for every 1-2 lines of code. You must write the C code for the problems first. See at the end of this document for the list of items you need to submit accordingly.

Problem 1: (12 points)

Write the MIPS assembly code to check if a number is positive or negative. Your program must take an integer input and print out whether the number is positive or negative. Your main program **must call a function** - **int isPositive(int num),** that takes a number as an argument and returns 1 if the number is positive (or zero) and returns a 0 otherwise. Your program must print a message **"Your number is positive"** or **"Your number is negative"** in the main program (not inside the isPositive() function.)

Rubric:

Grading objectives	Points
MIPS code executes and gives correct output	**4**
C code	**1**
Screenshots of output with various input	**2**
Followed the function requirements	**3**

Documentation/Comments	**2**

Problem 2: (16 points)

Write the MIPS assembly code to find the sum of cubes of 10 integers. Your code must **take 10 integers as input** and store them into an array. Your main program must call a function - **int SumOfCubes(int array[])** that takes the **array reference as input** and **returns the sum of cubes** of the integers stored in each position of the array. You must use a loop to find the sum of cubes. You must output the following (notice the format of the output - it includes **an expression with all the input numbers cubed**, along with the result):

Suppose your array is [1, 2, 3, 4, 5, 6, 7, 8, 9, 10], your output must be:

Sum of cubes = 1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3 + 8^3 + 9^3 + 10^3 = 3025

Rubric:

Grading objectives	Points
MIPS code executes and gives correct output	**6**
C code	**2**
Screenshots of output with various test cases	**2**
Sum of cubes code in function	**2**
Used arrays as indicated	**2**
Documentation/Comments	**2**

Problem 3: (12 points)

Write the MIPS assembly code to find the area of a given shape. Your program must take a floating-point value and shape (Circle - 1, Triangle - 2) as input and return the circumference/perimeter and area of the shape. Assume the floating-point value units are meters and the triangle is an equilateral triangle.
[Note1: You can search for the expression to calculate the area and circumference/perimeter of these shapes.
Note 2: You can use 3.14 as Pi. Also, you can use other constants and avoid using math functions.]

Suppose your floating-point value = 10.34, shape = 2, your output must be:

The perimeter of the triangle with side = 10.34 meters is 31.02 meters.

The area of the triangle with side = 10.34 meters is 46.3 square meters.

Suppose your floating-point value = 5.6, shape = 1, your output must be:

The circumference of the circle with radius = 5.6 meters is 35.19 meters.
The area of the circle with radius = 5.6 meters is 98.52 square meters.

Rubric:

Grading objectives	Points
MIPS code executes and gives correct output	**4**
C code	**1**
Screenshots of output with various test cases	**2**
Used functions	**1**
Used floating point registers	**2**
Documentation/Comments	**2**

What to turn in?

1. C code for all three problems in a single pdf file (c_code.pdf).
2. .asm file (MIPS code) for each problem (name the files prob1.asm, prob2.asm, prob3.asm).
3. Single pdf file with screenshots of the output of the three MIPS programs (screenshots.pdf).
4. Create a folder with your name. Put all the .asm and pdf files inside that folder (total 5 files). Create a zip file of that folder and submit the single zip file to Canvas
5. If you provide screenshots of the MIPS code and not the .asm files, your work will not be graded.