2021 Spring CPSC 240
Assignment 4 King of Assembly
Revised 20-April-2021

Announcements. On April 15 the instructor worked continuously throughout the day attempting accomplish one small thing, namely: execute a gdb command obtained via redirection at a point within an assembly source file. Here is what that means. A program is executing instructions from an x86 source file. Ordinary inputs and gdb commands are intended to be transmitted by redirection from a text file to the gdb run-time system. After more than 8 hours of effort to make it happen your professor has concluded that the gdb either does not support this feature or the solution is so obscure that the search for the solution is no longer cost effective. To side step this roadblock two small items in this requirements document were modified. The items that were modified are highlighted in pink. This action removes the controversial gdb commands from assembly and places them in C+.+.

Special acknowledgment to Luke Eltiste, who first brought this controversy to my attention and lent me a few files of source code that really convinced me of the need for a revised edition of this Assignment description.

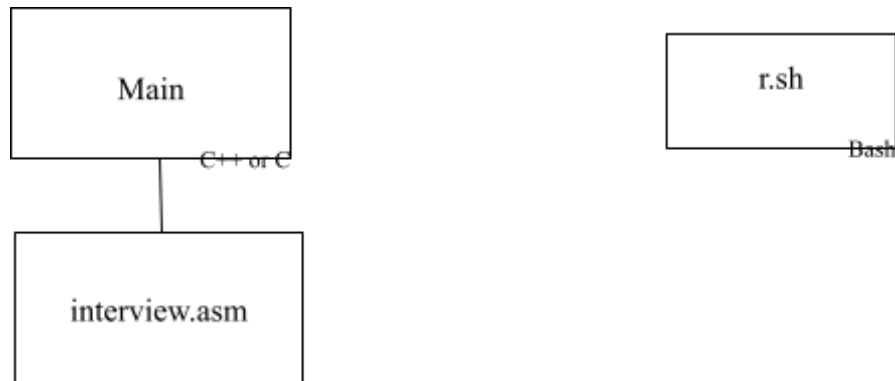One day was added to the due date to compensate for April 20.

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Assignment 4 King of Assembly

New technology found in this program.

> How to input a string with embedded white space
> Practice in use of gdb commands
> How to input a char
> How to use an input data file.

Structural design

This is going to be easy.   You only need two modules.

However, this is a rare case. This is the only time the driver (main) gets involved with the solution. You may need two bash files, one named r.sh and the other named rg.sh.

Three kinds of programmers

Your software has to accommodate all three kinds: social science majors, CS majors, and assembly programmer types.

Part 1

Build a program that handles all three kinds of job applicants shown in the following dialogs.

If the person applying for a job at your company is a CS major type then the dialog goes like this:

Welcome to Software Analysis by Paramount Programmers, Inc.
Please enter your first and last names and press enter: Joey Brown
Thank you Joey Brown. Our records show that you applied for employment here with our agency a week ago.
Please enter your expected annual salary when employed at Paramount: 500500.50
Your interview with Ms Linda Fenster, Personnel Manager, will begin shortly.
Hello Joey Brown. I am Ms Fenster. The interview will begin now.
Wow! $500500.50 That's a lot of cash. Who do you think you are, Chris Sawyer (y or n)?n
Alright. Now we will work on your electricity.
Please enter the resistance of circuit #1 in ohms: 2.0
What is the resistance of circuit #2 in ohms: 3.0
The total resistance is 1.2000000000000000 Ohms.
Were you a computer science major (y or n)?y
Thank you. Please follow the exit signs to the front desk.
Hello Joey Brown I am the receptionist.
This envelope contains your job offer with starting salary 88000.88. Please check back on Monday morning at 8am.
Bye

Color code: The part in yellow is produced by the interview module. The remainder comes from the driver.

The floating point number 88000.88 is returned to front desk whenever a CS major completes the interview and answers correctly the technical question about Ohms../x86-io.out

If the person applying for a job at your company is Chris Sawyer then the dialog goes like this.

Welcome to Software Analysis by Paramount Programmers, Inc.
Please enter your first and last names and press enter: Chris Sawyer
Thank you Chris Sawyer. Our records show that you applied for employment her with our agency a week ago.
Please enter your expected annual salary when employed at Paramount: 500500.50
Your interview with Ms Linda Fenster, Personnel Manager, will begin shortly.

Hello Chris Sawyer. I am Ms Fenster. The interview will begin now.
Wow! $500500.50 That's a lot of cash. Who do you think you are, Chris Sawyer (y or n)?y
Thank you. Please follow the exit signs to the front desk.

Hello Mr Sawyer. I am the receptionist.
This envelope has your job offer starting at 1 million annual. Please start any time you like. In the middle time our CTO wishes to have dinner with you.
Have very nice evening Mr Sawyer.

If Chris applies for a job then Ms Fenster sends the code number 1 000 000.00 to the front desk.

If the person applying for a job at your company is a social major then the dialog goes like this.

Welcome to Software Analysis by Paramount Programmers, Inc.
Please enter your first and last names and press enter: Joey Brown
Thank you Joey Brown. Our records show that you applied for employment her with our agency a week ago.
Please enter your expected annual salary when employed at Paramount: 500500.50
Your interview with Ms Linda Fenster, Personnel Manager, will begin shortly.
Hello Joey Brown. I am Ms Fenster. The interview will begin now.
Wow! $500500.50 That's a lot of cash. Who do you think you are, Chris Sawyer (y or n)?n
Alright. Now we will work on your electricity.
Please enter the resistance of circuit #1 in ohms: 5.3
What is the resistance of circuit #2 in ohms: 7.5
The total resistance is 4.976 Ohms.
Were you a computer science major (y or n)?n
Thank you. Please follow the exit signs to the front desk.
Hello Joey Brown I am the receptionist
We have an opening for you in the company cafeteria for $1200.12 annually.
Take your time to let use know your decision.
Bye

If the philosophy major applies for the job then Ms Fenster sends 1200.12 to the front desk in a private envelope.

Part 2

Create a bash file that will run the program in GDB mode. Find the gdb commands that will implement the following actions.

Before the program run set breaks at main, interview and at "Wow".

Show all the existing breaks

Use the command to start execution

After "Enter your expected"
        Show rbp
        Show rsp
        Show the current AR (all the quadwords between rsp and rbp) in order of increasing addresses
        Show the expected salary in the AR
        Show the data in the register holding the expected salary

After "will begin shortly" has executed
        Show rbp and rsp   //This will confirm you are in a new AR
        Show the quadword in hex in the quadword immediately preceding rbp
        Show the answer to the yes-no question. First find where it is stored.

After the words "I am the receptionist"
        Show the value that was returned to the driver. Is it still in the passing register?
        Show the value in the rsp and rbp in hex.. This will the fact that the old AR has disappeared.

After the "Bye"
         Show the value in rip in hex.

Next, research the gdb commands you need for this part 2.

Run the program in interactive mode. That means a human has to respond to request for keyboard input. When that is successful move to part 3.

Part 3

Create a text (ascii) file containing all the keyboard inputs. Do this three times. Make an input file csmajor.txt, which contains all the inputs for a complete run for a CS major applying for a job.

Make a text file chris.txt contain all the keyboard inputs for a complete run for Chris applying for a job.

Make a text file social.txt containing all the keyboard inputs for a complete run for a social major applying for a job.

Test your files by entering commands like these into the bash window.

    gdb ./interview.out < csmajor.txt

    gdb ./interview.out < chris.txt

    gdb ./interview.out < social.txt

Check your results for accuracy.

Part 4

Deliver the project. Send to the professor, acting as customer, the project. That means send these file to the usual place:

    main.cpp
    interview.asm
    r.sh
    rg.sh
    chris.txt
    csmajor.txt
    social.txt

Send seven files as seven attachments. Do not zip them.

Submission window: 5:00am of April 26 to 5:00am of April 27. [24 hours]

It is still 24 hours, but the start and stop hours have shifted due to day light pacific time zone.

Ethical standards

You are probably aware that I believe in an open source caring and sharing programming community. That means I endorse students forming communities for study and sharing of knowledge. You may freely share information and snippets of code with peers.

However, there is one academic restriction. Because this is an educational institution there is one restriction: don't give entire functions away until after the due has passed. Please don't post an entire program until the due date has passed. After the due date has past then post your homework and share it with the whole world.   Github is just waiting for your homework to be posted there.

Providing a 10-line snippet to a classmate is fine. Providing an entire function to a classmate teaches him nothing.   Verbal discussion may provide valuable tutoring.

One minute after the last instant for submission of a program then plaster your homework all around the world. Maybe your homework will help someone else.