

Assignment Project Exam Help

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DEVELOPMENT TOOLS

SEC204

OVERVIEW

- We'll briefly discuss development tools

- Assembler
- Linker
- Debugger
- Compiler
- Object code disassembler

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- Then we'll do practical activities
 - Create your own cheat sheet for gcc, gdb, objdump
 - Create a simple program
 - Observe the fetch, decode, execute cycle when running a program

ASSEMBLER, LINKER

ASSEMBLER

- Converts the Assembly language source code to instruction code for the processor
 - Instruction code varies for different assemblers (even for the same architecture)
 - Assembler Directives instruct the assembler how to construct the instruction code program. They are unique to the individual assembler.
- Examples include
 - MASM
 - NASM
 - **GAS**
 - HLA

LINKER

- Links objects, resolves all defined functions and memory address labels declared in the program code
 - For external functions (eg printf) usually a second step is required to link the assembly object code with other external dynamic libraries and allow the executable to run on the host system
- ld command

```
ld -o test test.o
```

Creates executable file test from the object file test.o

DEBUGGER

- Very important. Runs the program within its own controlled “sandbox”
- Runs the program in a controlled environment, specifying runtime parameters
- Stops the program at any point within the program
- Examines data elements, such as memory locations or registers
- Changes elements in the program while it is running to help bug removal
- GDB

```
gcc -gstabs -o test test.c
```

- `gdb test`
- Compiles `test.c` using debugging information to create executable file `test`. Then opens it in debugging mode with `gdb`.

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GDB COMMANDS

- `break` – Set a breakpoint
- `watch` – Set a watchpoint to stop execution when a variable reaches the specific value
- `info` – observe system elements, such as registers, the stack, memory
- `x` – examine memory location
- `print` – Display variable values
- `Run` – Start execution
- `list` – List specified functions or lines
- `next` – Step to the next instruction in the program
- `step` – Step to the next instruction in the program
- `cont` – Continue executing the program from the stopped point
- `until` – Run the program until it reaches the specified source code line (or greater)

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COMPILER, OBJECT CODE DISASSEMBLER

- COMPILER

- Converts high level code into assembly language and then into instruction code for the processor to execute.

- gcc

- gcc -o test test.c

Creates executable file test from C language program test.c

- OBJECT CODE DISASSEMBLER

- Takes a full executable program (or an object code file) and displays the instruction codes that will be ran by the processor
 - Some disassemblers convert the instructions into Assembly language syntax (mnemonics)

- gcc -c test.c

objdump -d test.o

Creates an object file by compiling test.c. Then display the disassembled object code file with objdump.

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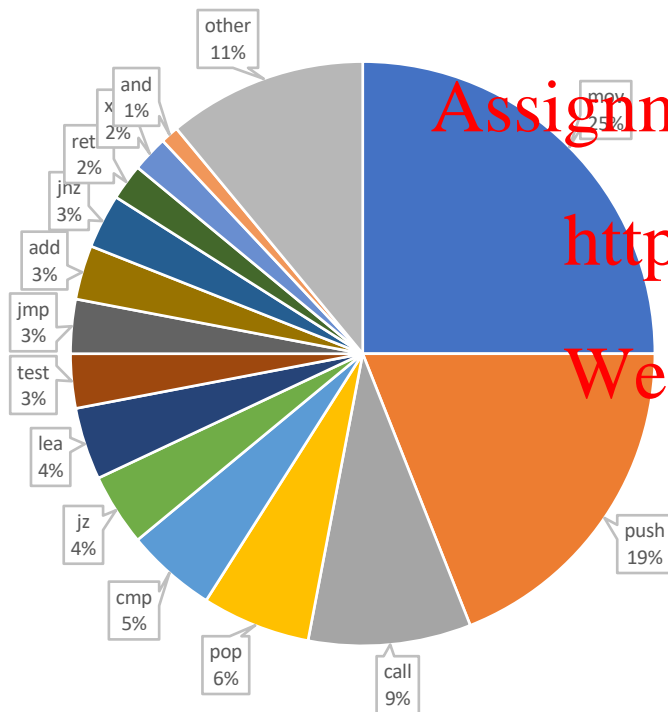
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PRACTICAL ACTIVITIES

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ASSEMBLY TASK

Opcode Breakdown in Goodware



Remember these Assembly instructions?

- ☐ Find out what the first 5 can do
- ☐ You can use the internet or the IA 32 cheat sheet on DLE

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REFERENCE: DATA TYPES IN C

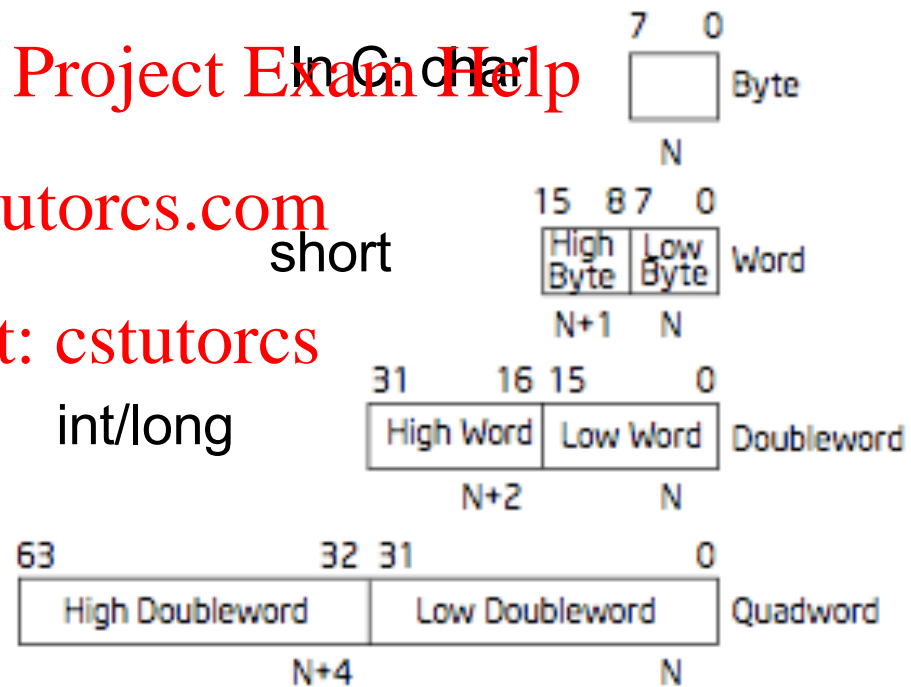
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int/long

double/long long



CREATE A SIMPLE PROGRAM

RUN IT STEP BY STEP

- We will create a simple program in C that calculates $\text{sum} = x + y$, where x , y , sum are numbers (short)
- Then we will compile it, and run it
- Then we will enter debug mode and run it step by step to observe the fetch decode execute cycle.
 - Watch register values after each step
- Then we will disassemble the program to view the assembly code

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- C Reference:
 - <https://www.tutorialspoint.com/cprogramming/index.htm>
- Remember to create a cheat sheet file with commands you use as you go along. This will help you in future labs.