ENGR151 Recitation Class 4

week 6

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Computer & Programming, MatLab-scripting

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Presentation Overview

Disclaimer:
The answers provided here are not guranteed to be correct. Please use them as a references only and verify with reliable source.

Note:
only go through some questions that we think they are necessary.

C5 Playbook Review

What is the benefit of C compared to assembly?

- Higher-level abstraction
- less code
- faster development

Note: click here for more about assembly

What is UNIX?

UNIX is a multitasking, multi-user operating system.
serves as the foundation for many modern operating systems, including Linux and macOS.

Note: click here for more about unix

C5 Playbook Review

Explain what the zero overhead principle is?

No additional performance or memory cost is introduced by using higher-level constructs (e.g., classes or functions).

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- serves as the foundation for many modern operating systems, including Linux and macOS.

C5 Playbook Review

Why Avoid Microsoft Visual C++ in ENGR151

- **Window centered!!!:**It is primarily designed for Windows applications, which limits portability to other platforms like Linux or macOS.
- Limited Support for Standard Libraries.
- Limited Compiler Compatibility: Your code might work well here, but issues often happen when compiling code with another comipler.

Function Prototypes and gcc What is a function prototype?
A function prototype declares a function's name, return type, and parameters without implementation, informing the compiler how the function will be called.

- Example: `int add(int a, int b);`

C5 Playbook Review

What is gcc?
gcc is the GNU Compiler Collection used to compile C, C++, and other languages.
How to compile a C program?
Use the command:

```
gcc -o (+ gcc flags to maintain good code and easy
      debugging) program_name source_file.c
```

C5 Playbook Review

Variable Scope What is the scope of a variable?

- **Local scope**: Inside a function or block; accessible only within that block.
- **Global scope**: Declared outside any function; accessible throughout the program.
- **Static scope**: Retains value across multiple function calls but accessible only within the same function.

Note: Never use global variable in ENGR151, it is not necessary.

C5 Playbook Review

Common Shortcut Operators Example Program:

C5 Playbook Review

What is a header file?
A header file contains function prototypes, macro definitions, and constants for reuse across multiple source files.
Why include header files at the top?
To ensure all necessary declarations and dependencies are available before compiling.

C5 Playbook Review

What does #define do?

#define is used to define macros or constants at compile time.

- Example: `#define PI 3.14159`

How does #define differ from variables?

- do not use memory at runtime
- the compiler substitutes the value or expression wherever the macro appears.

Usages for #ifdef

- Conditional Compilation: Include or exclude code based on whether a symbol is defined.
- Check if necessary libraries and header files are included.

C5 Playbook Review

Advantages and Drawbacks of Macros Advantages:

- Improves code readability and reuse.
- Faster than functions (no runtime overhead).

Drawbacks:

- Harder to debug.
- No type checking, leading to potential bugs.

Functions as macros:
Simple functions that involve small computations, e.g.:

```
#define SQUARE(x) ((x) * (x))
```

C5 Playbook Review

Identifying Mistakes Example:

```
 int main() {
     printf("Hello, world!);
     return 0;
}
```

Error: Missing closing quote.

Message: `Try it yourself...`

C5 Playbook Review

Why avoid writing everything in main()?
Reduces code readability and makes debugging difficult. Better to break code into modular functions.
Good function length in ENGR151:
Typically, 10–30 lines, focusing on one task.
Good file length in ENGR151:
aournd or less than 100 lines to maintain readability and manageability!

C5 Playbook Review

How is the original file split?
By dividing code into header files and source files.
What is #ifndef used for in ans.h?
#ifndef prevents multiple inclusions of the same header file, avoiding redefinition errors.
How to compile multiple files?
use makefile! Try not to use bash command line, messy and hard to change...
Why include ans.h in both ans_main.c and ans.c?
To ensure both files have consistent declarations and can use shared functions.

C5 Playbook Review

What is a library?
A library is a collection of precompiled functions that can be reused in different programs.
Why is -lm necessary when using mathematical functions?
The `-lm` flag links the math library, which contains functions like `sqrt()` and `cos()`.

C5 Playbook Review

What are all the gcc flags and their importance?

- **-o**: Specify output filename.
- **-Wall**: Enable all warnings.
- **-g**: Include debugging information.
- **-O**: Optimize the code.
- **-c**: Compile without linking.

C5 Playbook Review

Why is -lm necessary when using mathematical functions?
The `-lm` flag links the **math library** ('libm'), which contains functions like `sqrt()` and `cos()`.
What are all the gcc flags and their importance?

- **-o**: Specify output filename.
- **-Wall**: Enable all warnings.
- **-g**: Include debugging information.
- **-O**: Optimize the code.
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Note: For some questions, we won't directly provide the entire source code. Instead, we will provide ideas, a piece of code or pseudo-code to help guide you through worksheet questions.

W5 Review

Decode and run the following program.

```
#define fosho def
#define kthx return
#define wutz print

fosho double(x):
    kthx x * 2
wutz(double(6))
```

W5 Review

```
def double(x):
    return x * 2
print(double(6))
```

W5 Review

1. Using chapter 2, write a C program which returns the density of a body given its circumference, and both the distance and period of a body orbiting around it. Read the data from the keyboard.

2. What variable(s) can be defined using `#define`? Adjust your code accordingly.

- Unchangeable variables?
- Constants

`Try it out yourself!`

Calculate Density of a Body

Code:

```
#define PI 3.1415927f
#define G 6.674e-11f // Gravitational constant
```

// Function to calculate the density of the body

```
float calculate_density(float circumference, float
distance, float period) {
    float radius = circumference / (2 * PI);
    float volume = (4.0f / 3.0f) * PI * pow(radius,
3);
    float mass = (4 * PI * PI * pow(distance, 3)) /
(G * period * period);
    return mass / volume;
}
```

W5 Review

The XOR swap algorithm is an algorithm that swaps two values of distinct variables without using any temporary variable.

1. Write a `#define SWAP(a,b)` macro to swap two integers `a` and `b`.

`Hint: look up how xor can be used`

2. Write a short C function to demonstrate the previous macro.

XOR Swap Macro

Macro Cod e:

```
#define SWAP(a, b) \
        a = a ^ b; \
        b = a ^ b; \
        a = a ^ b; \
```

References

- Manuel. *c2.pdf*. JI Canvas, 2024. [Link].
- Manuel. *c3.pdf*. JI Canvas, 2024. [Link].
- Manuel. *w3.pdf*. JI Canvas, 2024. [Link].
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The End

Questions? Comments?