C PROGRAMMING AND ASSEMBLY LANGUAGE

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PRE-REQUISITES : Students are expected to have done a course on C programming and Microprocessors
INDUSTRIES APPLICABLE TO : Almost all software companies and many hardware companies **INTENDED AUDIENCE**: Any Interested Learners

COURSE OUTLINE :

Students who complete their bachelors degree (BE/ BTech) in computer science or electrical engineering do extensive course work in Microprocessors and then in C programming. However, what is missing in the current curriculum is to explicitly establish the link between the two. Specifically we look at how a C program is translated to assembly language and how it eventually gets executed on a microprocessor. Through, animations we show what happens in the stack, data and code segment, of the microprocessor when a C program is executed.

ABOUT INSTRUCTOR :

Prof. Janakiraman Viraraghavan is an assistant professor at the Department of Electrical Engineering, IIT Madras and is part of the Integrated Circuits and Systems (iCS) group. His research interests include porting machine-learning algorithms on to hardware and statistical analysis in VLSI. He also has a keen interest in Microprocessors and Programming in general.

COURSE PLAN :

WEEK 1: Introduction to Microprocessors and Assembly language Programming
- Microprocessor Architecture
- Machine Language Execution sequence in a MuP
- Memory in a microprocessor
- Instruction Set
- ADDRESSING SCHEMES
- MOV
- ARITHMETIC AND LOGICAL INSTRUCTIONS
- FLAG REGISTER
- STACK INSTRUCTIONS
- CALL and RET
- HARDWARE LOOPS

WEEK 2: Introduction to C and Inline Assembly
- Data types and their sizes
- Simple examples of Inline assembly
- ALU operations
- String length
- Multiplication using repeated addition
- Swap two variables in C
- Swap two variables in inline Assembly
- Function to swap two variable in C
- Inline code to swap the two variables using a function

WEEK3: Compiling C to Assembly Language
- Compiling a simple program to Assembly – first order
- Passing parameters
- Prologue
- Epilogue
- Local variables

WEEK4: C++ and Some special Functions
- C and C++ at assembly language level
- Recursion vs Loops with factorial as example
- Special functions
- memcpy
- strlen