Problem Solving through Programming in C

COE 251

WEEK 1: INTRODUCTION

Justice Owusu Agyemang, Department of Telecommunications Engineering, KNUST

About Instructor

Name: Justice Owusu Agyemang

Department: Telecommunications Engineering, CoE, KNUST.

Office: Caesar Building, Room 321.

Email: jay@knust.edu.gh

Research Interests: Internet of Things, Networks and Application Security, Applied Artificial Intelligence, Applied Cryptography, Reverse Engineering.

About this course

This course is aimed at:

- Formulating simple algorithms for arithmetic and logical problems.
- Translating the algorithms to programs (in C language).
- Decomposing problems into functions and synthesizing a complete application.
- Using arrays, pointers and structures to formulate algorithms and programs.

About this course

Course Grading:

Assignments	10%
Mid-Semester Exams	20%
Semester Project	20%
End of Semester Exams (Theory & Practicals)	50%
Total	100%

Recommended Books

- "The C Programming Language" by Brian W. Kernighan, Dennis M. Ritchie. 2nd Edition.
- "Programming with C" by Bryton Gottfried. 2nd Edition.

NB: Not limited to the above books.

Course Outline

- Idea of Algorithms.
- Flow Chart and Pseudocode.
- Introduction to Programming Language Concepts.
- Variables and Memory.
- Compilers and Interpreters.
- Introduction to the C Programming Language
  - Logical operations, flow of control, functions, arrays, pointers, structures and dynamic allocation.

Tools Needed

- Drawio - Diagramming tool.
  - macOS - https://github.com/jgraph/drawio-desktop/releases/download/v16.1.2/draw.io-universal-16.1.2.dmg
  - Windows - https://github.com/jgraph/drawio-desktop/releases/download/v16.1.2/draw.io-16.1.2-windows-installer.exe
  - Linux - https://github.com/jgraph/drawio-desktop/releases/download/v16.1.2/drawio-amd64-16.1.2.deb
- Visual Studio Code (For macOS & Linux Users) - https://code.visualstudio.com
- Codeblocks (For Windows Users - https://www.fosshub.com/Code-Blocks.html?dwl=codeblocks-20.03-setup.exe (including compiler).

Problem Solving through Programming (in C)

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Introduction

Some Common Problems

Problem 1:

How do you find the average of four numbers; (a, b, c, d)?

$$\text{Average} \equiv \text{Mean} \rightarrow \frac{a+b+c+d}{4}$$

What if the list of numbers is large?

$$x_1, x_2, x_3, \ldots, x_n, \quad \text{Average} \rightarrow \frac{x_1 + x_2 + x_3 + x_4 + \ldots + x_n}{n} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Introduction

Some Common Problems

Problem 2:

What's the sum of the first 5 positive integers ?

$$\text{Sum} = 1 + 2 + 3 + 4 + 5 = 15$$

What is the sum of 'n' positive integers ?

$$\text{sum} = 1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{n}$$

Introduction

Some Common Problems

Problem 3:

Consider the text below. How many times does the word "Facebook" occur?

The massive outage that took down Facebook, its associated services (Instagram, WhatsApp, Oculus, Messenger), its platform for businesses, and the company's own internal network all started with routine maintenance.

According to infrastructure vice president Santosh Janardhan, a command issued during maintenance inadvertently caused a shutdown of the backbone that connects all of Facebook's data centers, everywhere in the world.

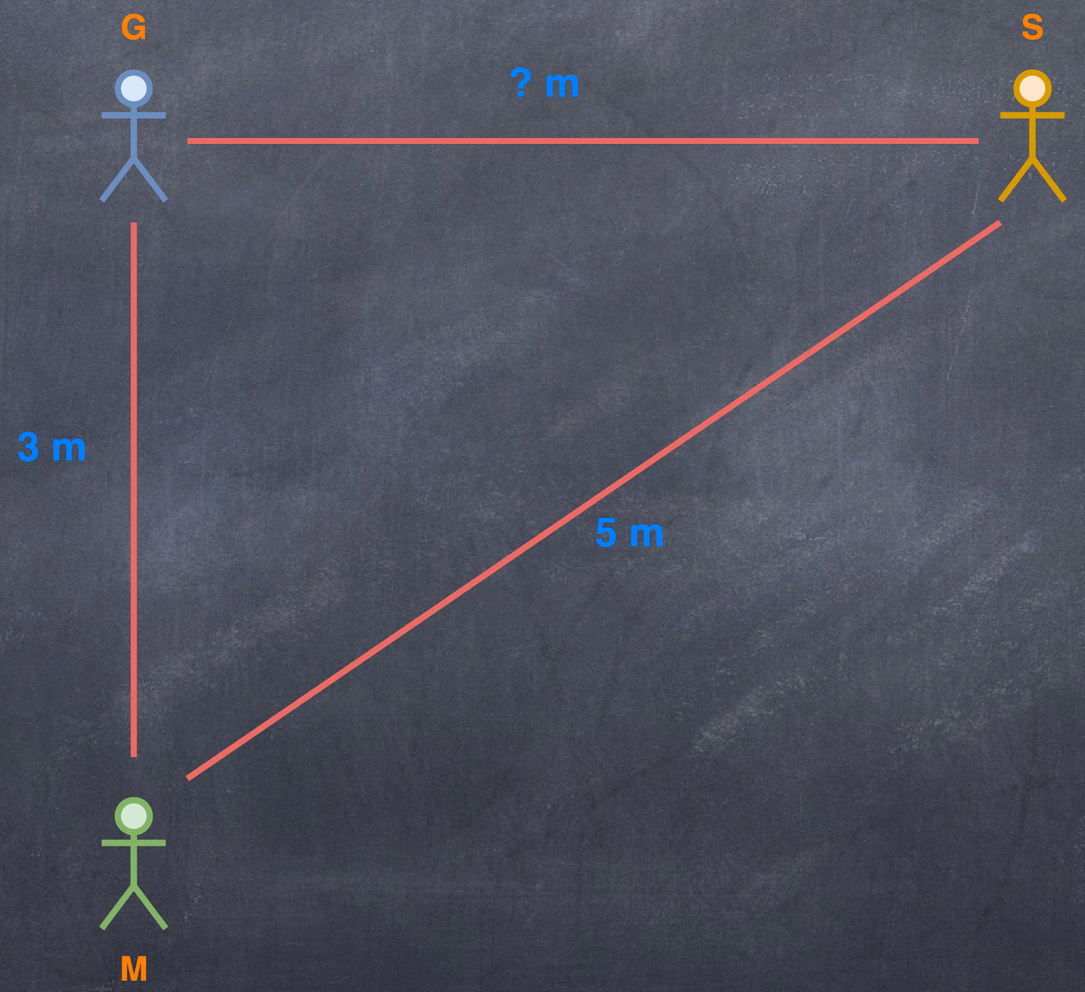
That by itself is bad enough, but as we've already explained, the reason you couldn't use Facebook is that the DNS and BGP routing information pointing to its servers suddenly disappeared. According to Janardhan, that problem was a secondary issue, as Facebook's DNS servers noted the loss of connection to the backbone and stopped advertising the BGP routing information that helps every computer on the internet find its servers. The DNS servers were still working, but they were unreachable.

Introduction

Some Common Problems

Problem 4:

What is the distance between G and S ?



Introduction

Some Common Problems

Problem 5:

How do we alleviate poverty in Ghana ?

NB: When we say problem solving through programming, we are referring to certain categories of problems, not all kinds of problems.

Next ...

Idea of Algorithms