

In June 2018, I asked to a group of 18,738 students,
*“Why do some students find programming in C, so
difficult?”*

The first answer was,
*“It involves thinking. We have been programmed by
our respective school boards not to think.”*



Also known as CS101, Introduction to Programming, Computer Programming, Computational Thinking, and Programming in C

Computer Programming in C

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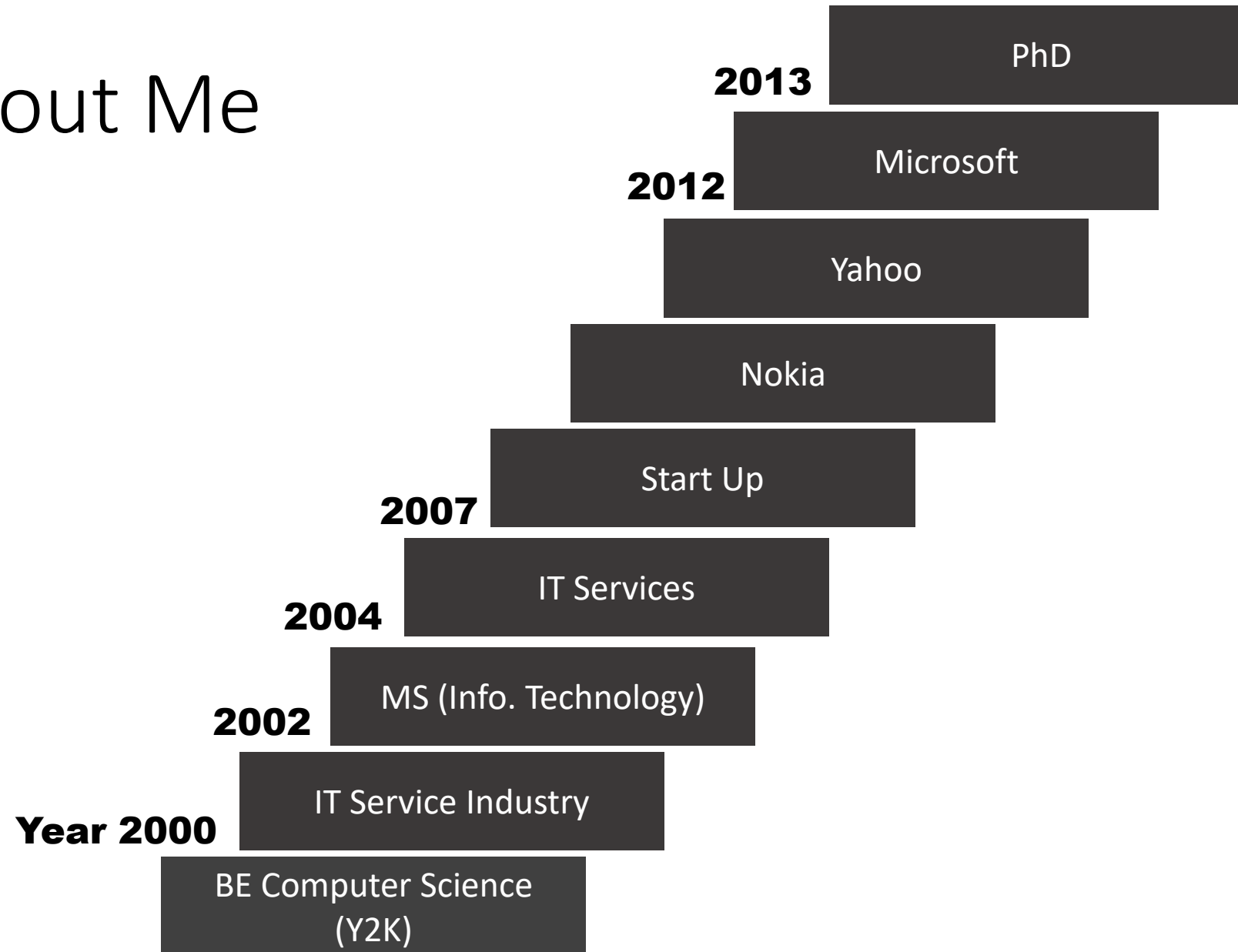
venkatesh.v@iiits.in

You Can Call Me

- Venkatesh
- Venky
- Venkat
- Vv
- ~~Sir~~

Mails addressing me as 'sir' may not get a response

About Me



Agenda

- About the Course
 - Know the Course
 - Know Your Instructor
- Your First C Program
 - Hello World!
 - Editing, Compiling and Executing the Program
- More C Programs
- Computational Thinking

House Rules

- Put your phones in silent mode.
- Raise your hand if you have a question.
 - For clarifications, you may interrupt anytime.
 - If your question can wait, hold on to it till the end of the section.
- Maintain Silence.

Course Objectives

- At the end of this course, you should be able to understand and write C programs up to 100 lines.
- Be able to think step-by-step, so as to write a computer program.
- Get proficient in developing and debugging programs written in C programming language
- Improve your problem solving skills

Why Learn to Code?

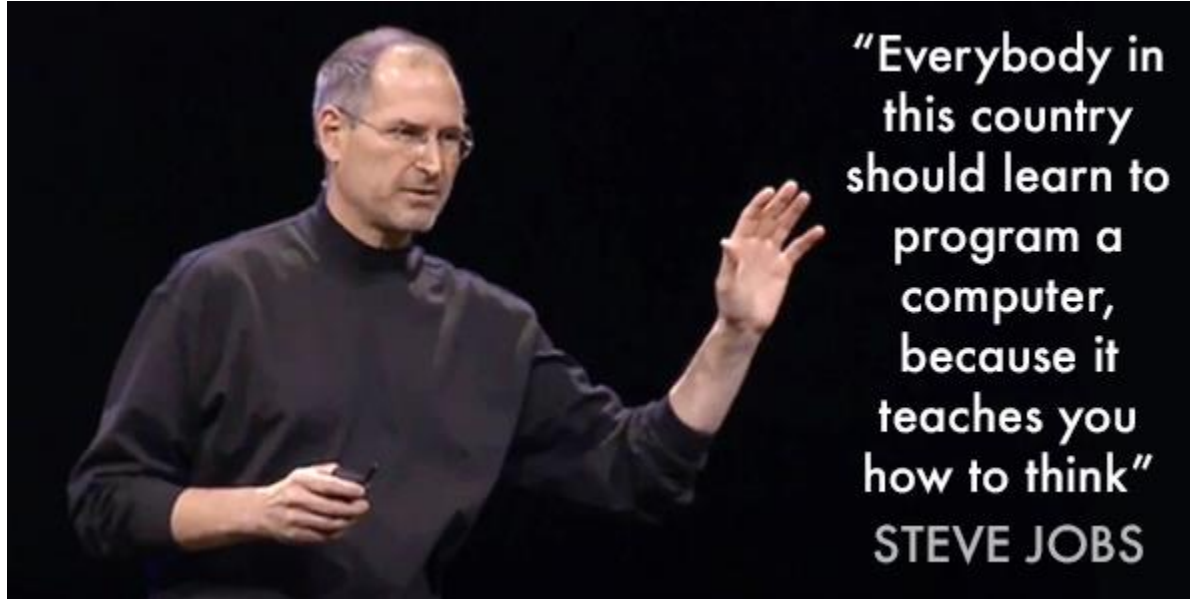


All of my friends who have younger siblings who are going to college or high school - my number one piece of advice is: You should learn how to program.

(Mark Zuckerberg)

izquotes.com

Why Learn to Code?

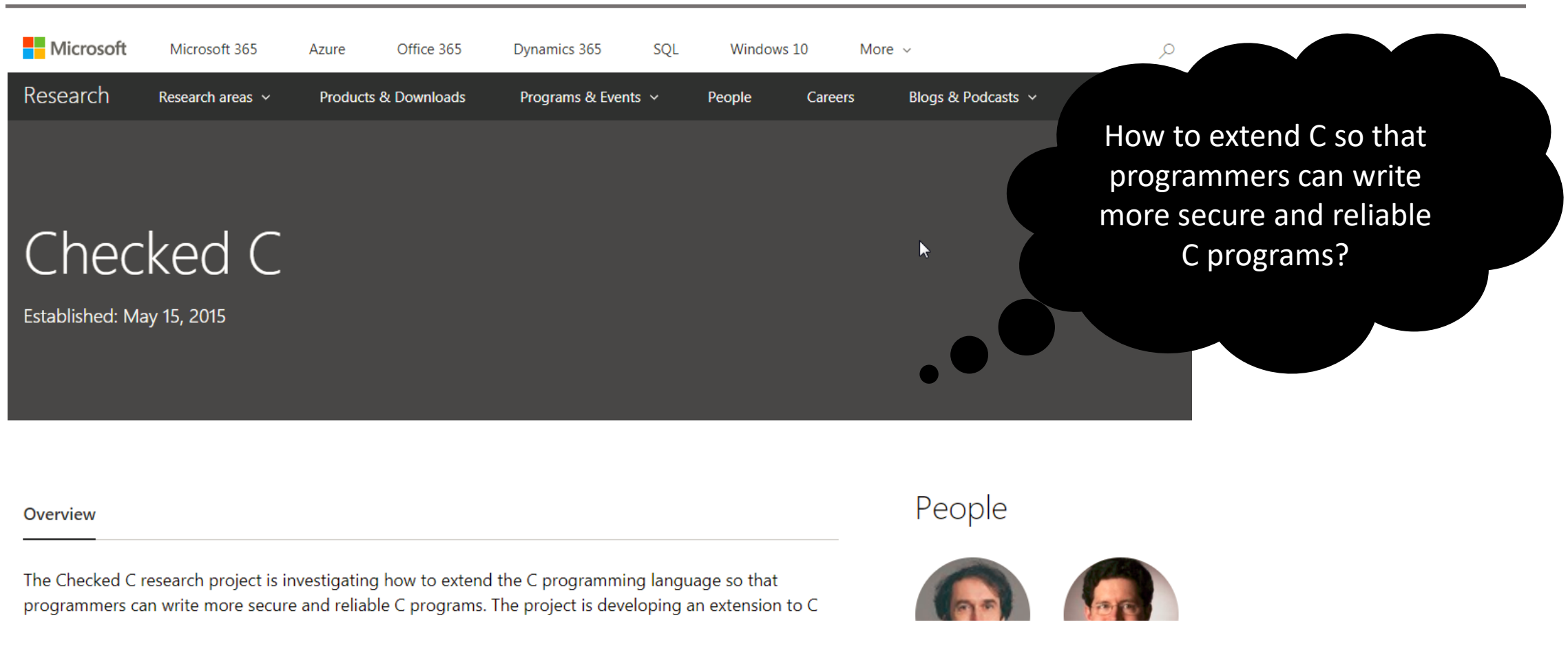


Why Learn C?

The screenshot shows the naukri.com website interface. At the top, there's a navigation bar with 'JOBS', 'RECRUITERS', 'COMPANIES', 'SERVICES', 'MORE', and 'LOGIN'. Below this, a secondary navigation bar lists 'All Jobs', 'IIT/IIM Jobs', 'Govt. Jobs', 'International Jobs', and 'Walk-in Jobs'. The main search area has a search bar with 'c programming' entered, and filters for 'Location/Locality', 'Experience', and 'Salary'. A 'Search' button is present. Below the search bar, there's a section for 'Find Jobs For' with a list of designations: 'Software Developer', 'Software Test Engineer', 'C Developer', 'Embedded Developer', 'C Programmer', and '...more'. The search results show '1-50 of 13828 C Programming Jobs'. A featured job is displayed: 'Sr. Eng-automotive Embedded S/W Dev(c-program,bms, CMC/ Hvcu) @ MNC' by 'Professional Access Resources Consulting Pvt. Ltd.' with '2-7 yrs' experience in 'Bengaluru'. The 'Keyskills' listed are 'CAN, AutoSar, Embedded, C Programmer, BMS, OMC HVCU'. The salary is '₹ 5,00,000 - 11,00,000 P.A.' and it was 'Posted by Prathap / Hema , 1 day ago'. On the right side, there's a section titled 'Includes 122 jobs in Featured Companies' with logos for 'Technosoft CORPORATION', 'SRM Technologies', 'CSG INTERNATIONAL', 'GlobalLogic', 'ORACLE', 'CUELOGIC', 'ZS', and 'accenture'.

As on June 2018,
13828 jobs in **122**
featured companies are
asking for C
programming skills!

Researchers and Scientists Care for C!



The image is a screenshot of the Microsoft Research website for the 'Checked C' project. The top navigation bar includes the Microsoft logo and links to Microsoft 365, Azure, Office 365, Dynamics 365, SQL, Windows 10, and a 'More' dropdown. Below this, a secondary navigation bar has links for Research, Research areas (with a dropdown arrow), Products & Downloads, Programs & Events (with a dropdown arrow), People, Careers, and Blogs & Podcasts (with a dropdown arrow). The main content area features the title 'Checked C' in large white text on a dark background, with the subtitle 'Established: May 15, 2015' below it. A large black thought bubble is overlaid on the right side of the page, containing the text 'How to extend C so that programmers can write more secure and reliable C programs?'. Below the main content area, there are two sections: 'Overview' and 'People'. The 'Overview' section has a horizontal line under its title and contains the text: 'The Checked C research project is investigating how to extend the C programming language so that programmers can write more secure and reliable C programs. The project is developing an extension to C'. The 'People' section has its title underlined and shows two circular profile pictures of men.

Microsoft Microsoft 365 Azure Office 365 Dynamics 365 SQL Windows 10 More ▾

Research Research areas ▾ Products & Downloads Programs & Events ▾ People Careers Blogs & Podcasts ▾

Checked C


Established: May 15, 2015

How to extend C so that programmers can write more secure and reliable C programs?

Overview

The Checked C research project is investigating how to extend the C programming language so that programmers can write more secure and reliable C programs. The project is developing an extension to C

People



Course Details

- Website: <http://vvtesh.co.in/teaching/CP.html>
- There are no pre-requisite courses for this course.
- Evaluation

Instrument	Max Marks
Midterm 1	15%
Midterm 2	15%
Final Exam	30%
Assignments (5 * 8% each)	40%
Bonus Project (optional)	0%

Project

- Optional.
- If you do it,
 - You will not get any marks.
 - It does not affect your grade.
- Then, why do it?
 - Gives you an opportunity to interact more with your instructor.
 - C is best learned by doing.
 - More work → More problems → More knowledge → More fun.

Exams

- Nature of Exams
 - All exams are of open-book type. Carry your own copy.
 - Exams test your understanding (and aptitude) of C.
 - To be successful
 - Do not spend time memorizing definitions.
 - Understand ideas and concepts.
 - Practice. Practice. Practice.
-

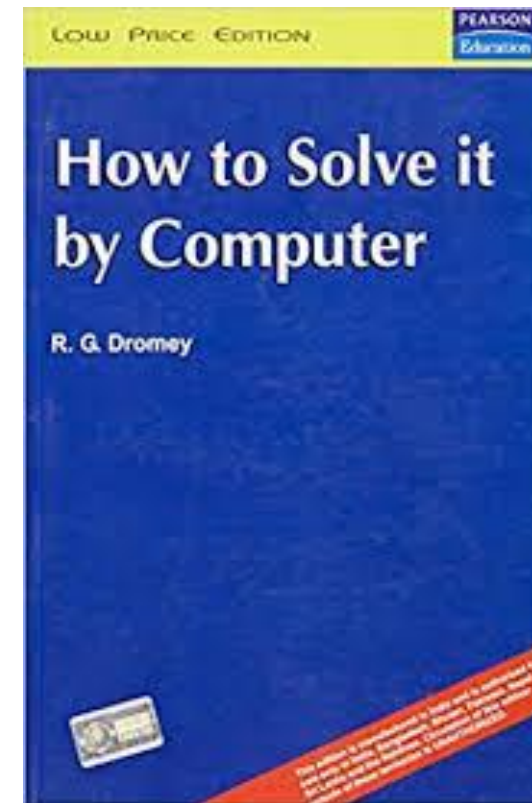
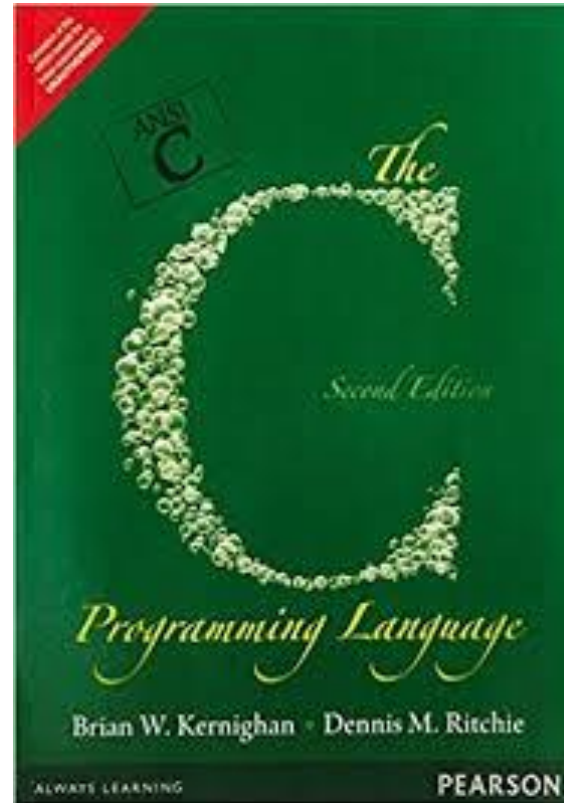
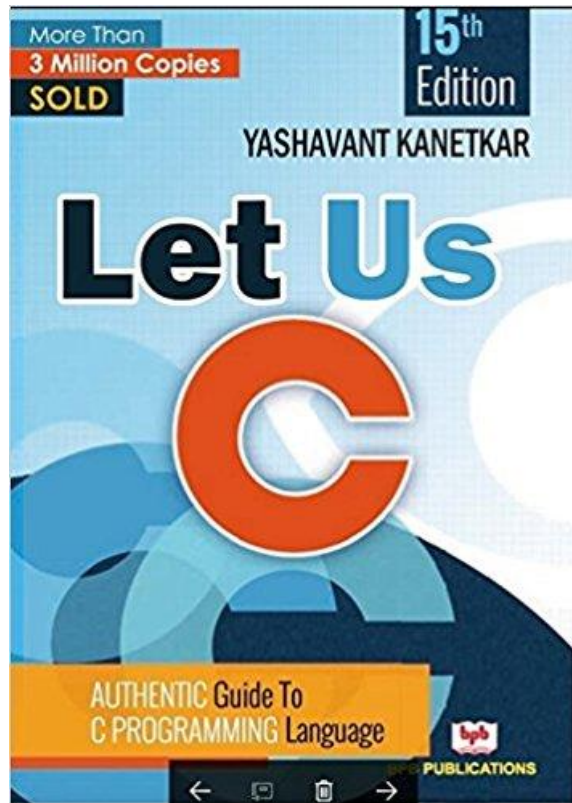
After the Class...

- Slides will be available at the course website.
- Keep a watch for course schedule, assignments, and announcements.

Schedule

Lecture	Topic	Readings	Lecture Slides	Labs/Tutorials	Assignment	Demo Code
1	Introduction	Chapter 1 and 2 from YK, C Mitch Resnick: Let's teach kids to code Learning to Code is Not Just for Coders	Lecture 1	Lab 1		hello.c guess.c
2	Decision and Case Control	Chapter 3, 4 and 7 from YK Chapter 3 from C			Assignment 1	
3	Loop Control	Chapter 5 and 6 from YK Chapter 3 from C				
4	Functions	Chapter 8 from YK Chapter 4 from C			Assignment 2	
5	Recursion	Chapter 10 from YK				
Midterm 1						
6	Pointers	Chapter 9 from YK				

Books



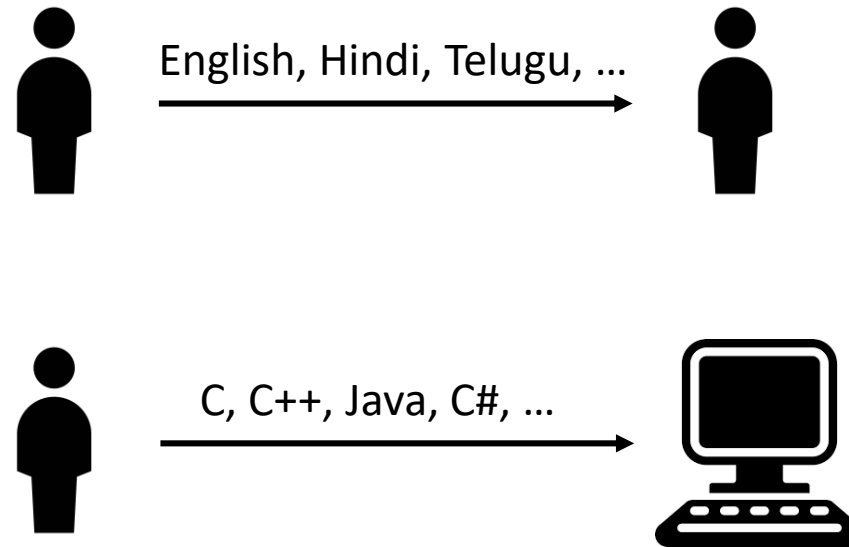
So, what did we discuss in Part I?

- House Rules
- About your Instructor
- Course Objectives
- Why Learn C?
- Course Details
- Project
- Exams
- Books

Part II

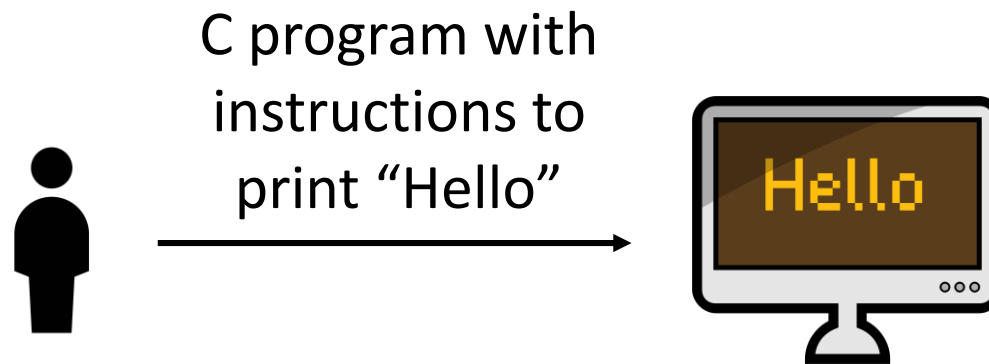
Write your first C program.

Communicating with the Computer

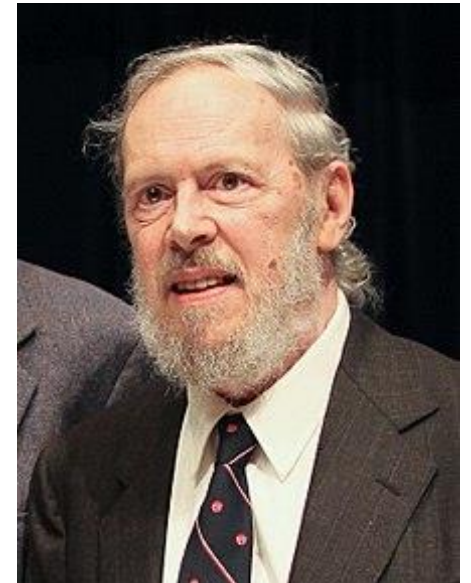


What is C?

- A way to communicate to the computer



Creator, C
Programming Language



Dennis Ritchie
1941 – 2011
Turing Award (1983)

Let us write a real C program

```
1 #include <stdio.h>
2 int main()
3 {
4     printf("Hello, World!");
5 }
```

Next Question: How to execute this program on a computer?

Demo

Editors

- You may use
 - Notepad
 - Code::Blocks
 - Visual Studio
 - Eclipse
 - ... and many more editors
- We will use Code::Blocks in this course.

Code::Blocks Installation

Download the mingw-setup.exe version. It comes with the compiler.


www.codeblocks.org/downloads/binaries

- Windows XP / Vista / 7 / 8.x / 10
- Linux 32 and 64-bit
- Mac OS X

NOTE: For older OS'es use older releases. There are releases for many OS version and platforms on the [Sourceforge.net](#) page.

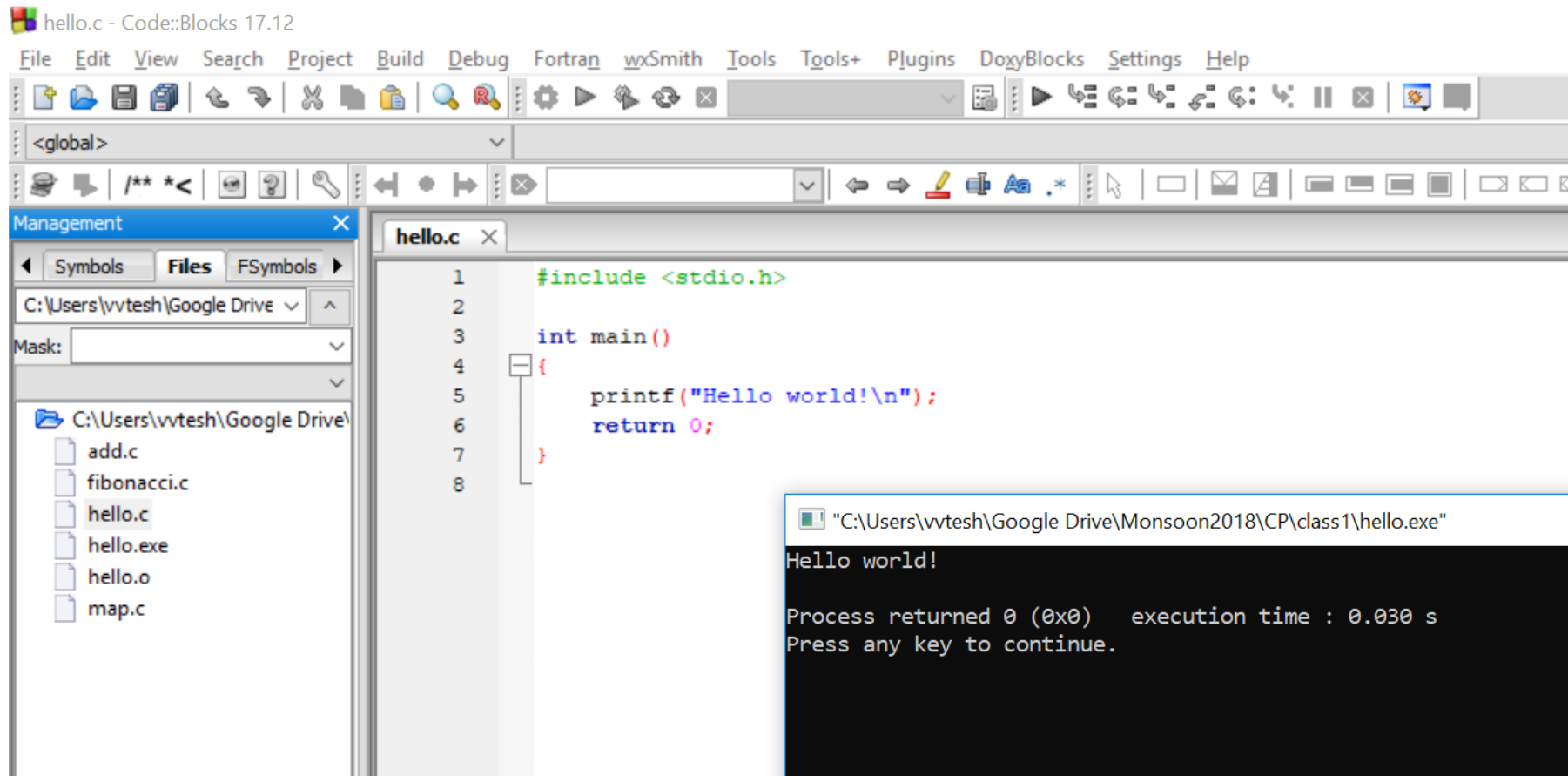
NOTE: There are also more recent *nightly builds* available in the [forums](#) or (for Debian and Fedora users) in [Jens' Debian repository](#) at [Fedora repository](#). Please note that we consider nightly builds to be *stable*, usually.

NOTE: We have a [Changelog for 17.12](#), that gives you an overview over the enhancements and fixes we have put in the new release.

 **Windows XP / Vista / 7 / 8.x / 10:**

File	Date	Download from
codeblocks-17.12-setup.exe	30 Dec 2017	Sourceforge.net
codeblocks-17.12-setup-nonadmin.exe	30 Dec 2017	Sourceforge.net
codeblocks-17.12-nosetup.zip	30 Dec 2017	Sourceforge.net
codeblocks-17.12mingw-setup.exe	30 Dec 2017	Sourceforge.net
codeblocks-17.12mingw-nosetup.zip	30 Dec 2017	Sourceforge.net
codeblocks-17.12mingw_fortran-setup.exe	30 Dec 2017	Sourceforge.net

Our First Program and Its Output!



The screenshot displays the Code::Blocks IDE interface. The title bar reads "hello.c - Code::Blocks 17.12". The menu bar includes File, Edit, View, Search, Project, Build, Debug, Fortran, wxSmith, Tools, Tools+, Plugins, DoxyBlocks, Settings, and Help. The toolbar contains various icons for file operations, editing, and execution. The left sidebar shows a "Management" pane with tabs for Symbols, Files, and FSymbols. The "Files" tab is active, showing a directory tree for "C:\Users\vvtesh\Google Drive\" containing files like add.c, fibonacci.c, hello.c, hello.exe, hello.o, and map.c. The main editor window, titled "hello.c", shows the following C code:

```
1  #include <stdio.h>
2
3  int main()
4  {
5      printf("Hello world!\n");
6      return 0;
7  }
8
```

Below the code editor, a console window is open, showing the output of the program:

```
"C:\Users\vvtesh\Google Drive\Monsoon2018\CP\class1\hello.exe"
Hello world!

Process returned 0 (0x0)   execution time : 0.030 s
Press any key to continue.
```

Live Demo

So, what did we discuss in Part II?

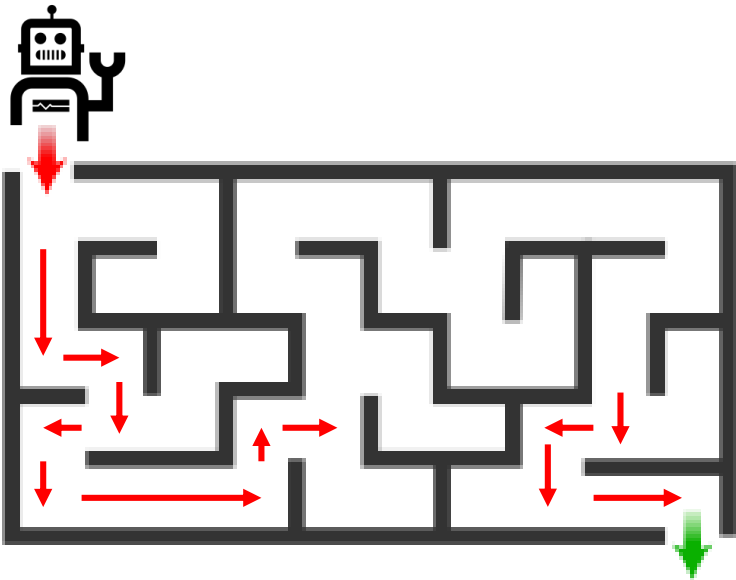
- What is C?
- Writing a C Program
- Compiling & Executing the Program

Part III

Computational Thinking: How to get good at writing programs?

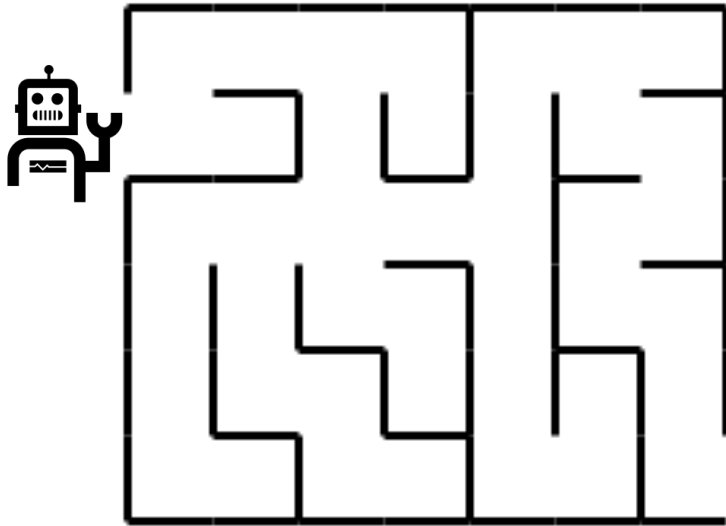
A Game

- You can only issue one of the four commands: right, left, up, down.
- The robot here will follow your command.
- Take the robot from source to destination. Give “**Instructions**”.



Answer: down, right, down, left,
down, right, up, right,
...
down, left, down, right, down.

Can you give me the “instructions” now?

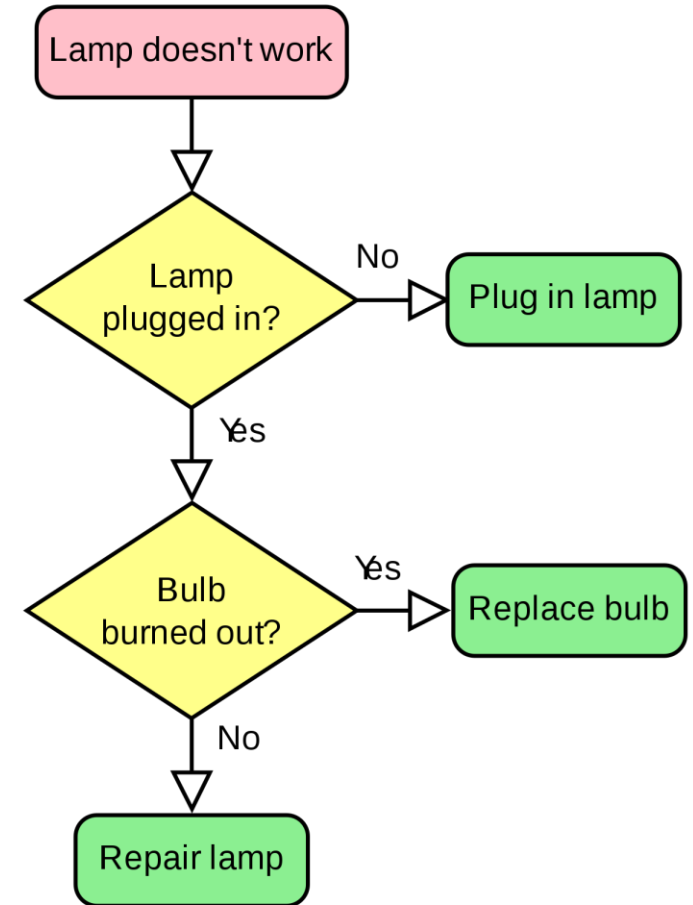


Which of these is the most likely set of instructions to take the robot to its destination (efficiently) ?

1. Right, up, right, down, right, up, ...
2. Right, up, right, up, right, up, ...
3. Right, up, left, left, down, right, ...
4. Right, left, right, left, right, left, ...

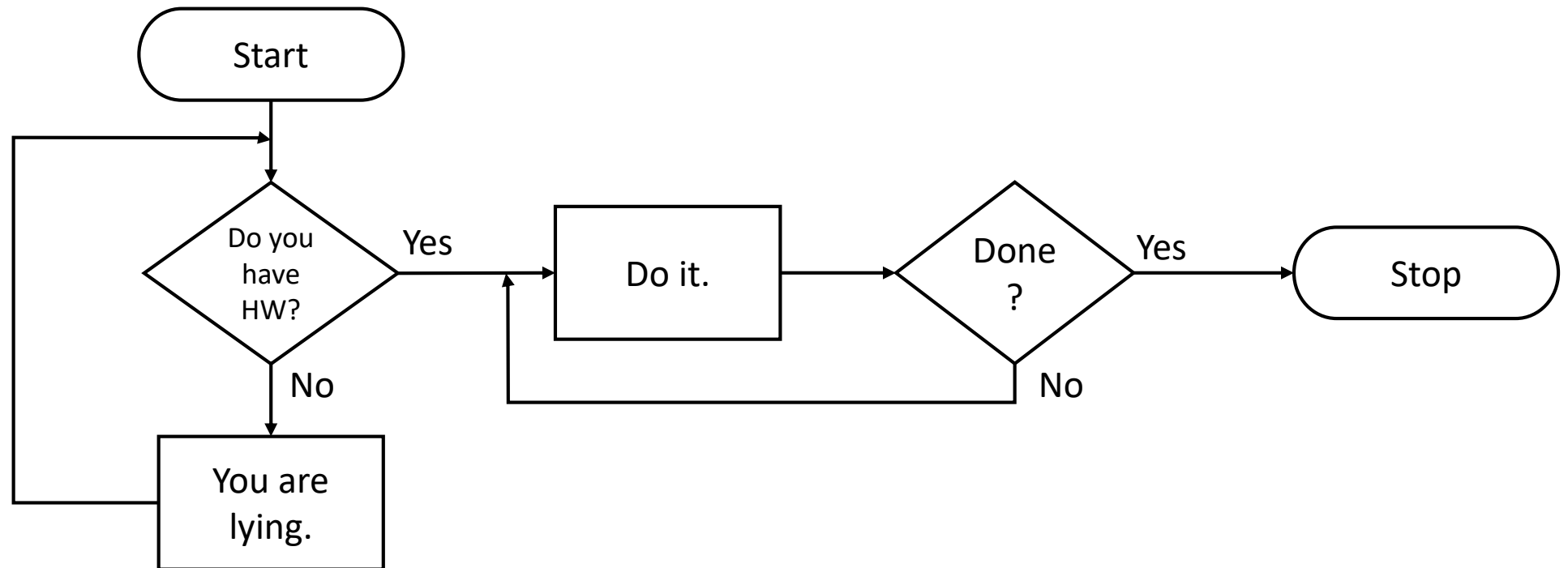
Flowcharts

- Flowcharts give a step-by-step description of a workflow.
- For example, what do you do when a lamp doesn't work?



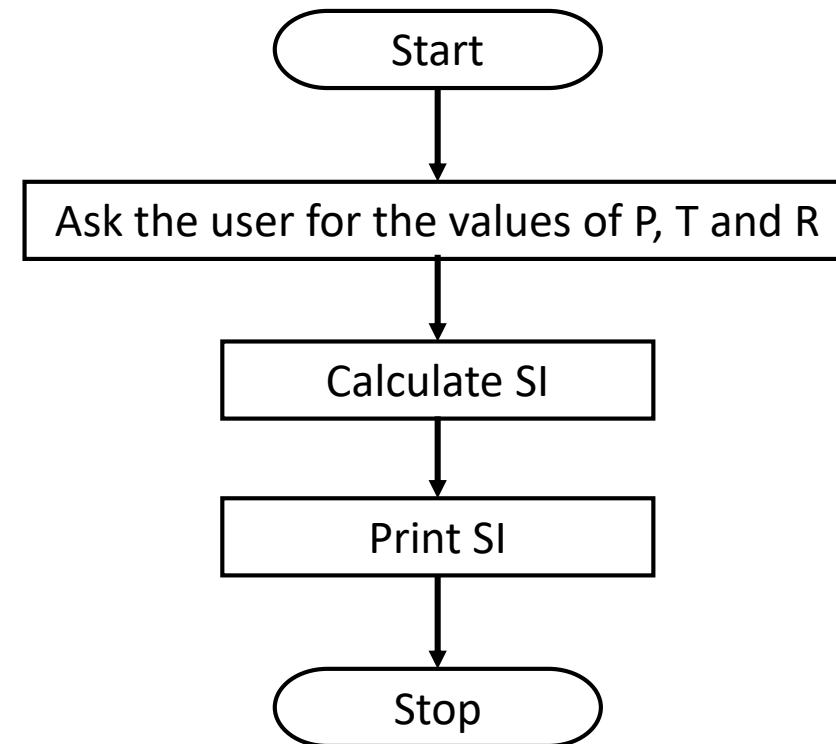
Another Flowchart Example

- Should I do my homework now?

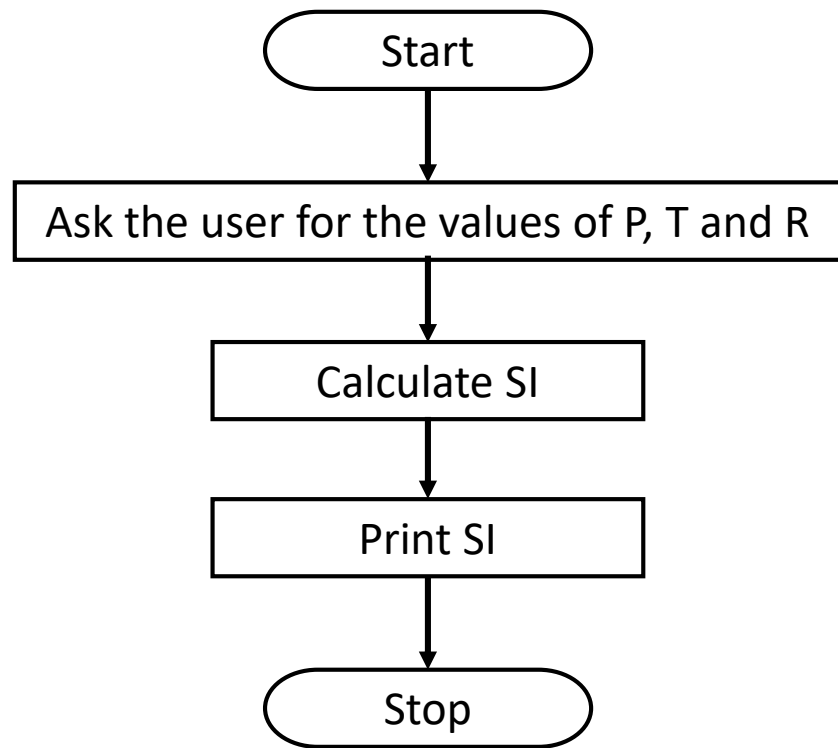


Write a C Program to Calculate Simple Interest

- First, we need to know the formula
 - Simple Interest, $SI = \frac{P * T * R}{100}$
 - Where P is Principal, T is Time, R is Rate
- Next,
 - Step1: Let us draw the flowchart
 - Step2: Write the C code

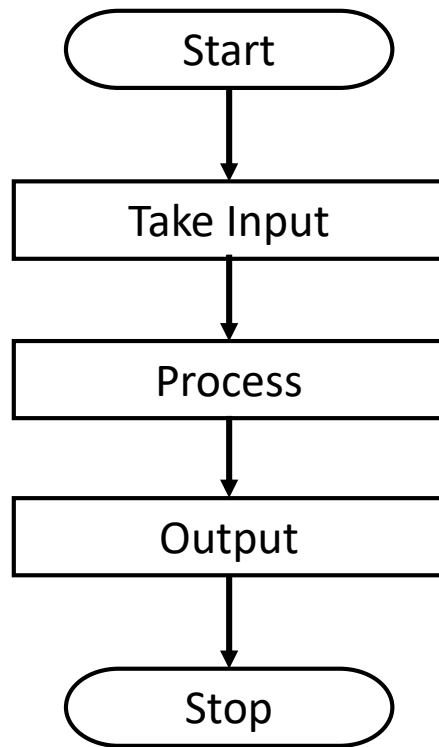


Converting Flowchart to C Code



```
1  #include<stdio.h>
2
3  int main() {
4      int amount, rate, time, si;
5
6      printf("\nEnter Principal: ");
7      scanf("%d", &amount);
8
9      printf("\nEnter Rate of Interest: ");
10     scanf("%d", &rate);
11
12     printf("\nEnter Time: ");
13     scanf("%d", &time);
14
15     si = (amount * rate * time) / 100;
16     printf("\nSimple Interest : %d", si);
17
18     return(0);
19 }
20
```

Simple Programs



```
1  #include<stdio.h>
2
3  int main() {
4      int amount, rate, time, si;
5
6      printf("\nEnter Principal: ");
7      scanf("%d", &amount);
8
9      printf("\nEnter Rate of Interest: ");
10     scanf("%d", &rate);
11
12     printf("\nEnter Time: ");
13     scanf("%d", &time);
14
15     si = (amount * rate * time) / 100;
16     printf("\nSimple Interest : %d", si);
17
18     return(0);
19 }
20
```


Add Two Numbers

```
1  #include<stdio.h>
2
3  int main() {
4      int x,y,result;
5
6      printf("\nEnter X: ");
7      scanf("%d", &x);
8
9      printf("\nEnter Y: ");
10     scanf("%d", &y);
11
12     result = x + y;
13     printf("\nSum = %d", result);
14
15     return(0);
16 }
17
```

C:\Users\Venkatesh\Desktop\a1.exe

Enter X: 10

Enter Y: 20

Sum = 30

Process returned 0 (0x0) execution time : 3.671 s

Press any key to continue.

Lab 1

- Refer to course website.

Why is programming in C, so difficult?

- Surveyed 18,738 students
 - Most were in final year, or have just completed their BTech in CSE.
 - These are students aspiring to give the GATE exam, to join PSU, MTech or PhD programs.
- The first response
 - *"...it involves thinking & we have been programmed by our respective school boards to not think."*

Interesting Responses

- “ I started coding in my 2nd sem & by the start of 5th sem I was better than most of my friends who were coding since school only because I was honest in learning.”
 - “teachers are not taking the practical aspects of programming language with importance.”
 - “the best way to make them understand is by relating it to real life things.”
 - “One require continuity and a lot of patience to improve in coding skills. Most of us wants to do things that won't take much time. They don't want to struggle in a code which would take 3-4 hrs or more.”
-

More Responses...

- “Everything individually sounds great but the correct use make the short circuit in brain. That is most of my fellowmate and I are bad programmers”
- “Some were already good before coming to college, some learnt stuff pretty fast, some like me who were left behind just gave up.”
- “most of them are afraid of syntax but not the algo.”

Key Results from the Survey

- We are afraid of the syntax (instructions), but not the ideas.
 - We should focus on the practical part.
 - Boring to copy syntax from book.
- We are not trained to think.
 - C programming requires a different way of thinking.
 - It is a very new thing which makes students uncomfortable.
- Debugging errors is difficult. Patience is an important quality for a coder.

So, what did we discuss in Part III?

- Instructions
- Flowcharts
- Converting flowchart to C code
- Why is C programming difficult?

Questions?

Hold on. There is one more slide.

What Can We Do...

Is only limited by our
imagination

Can you guess what this little C program will output?

Demo

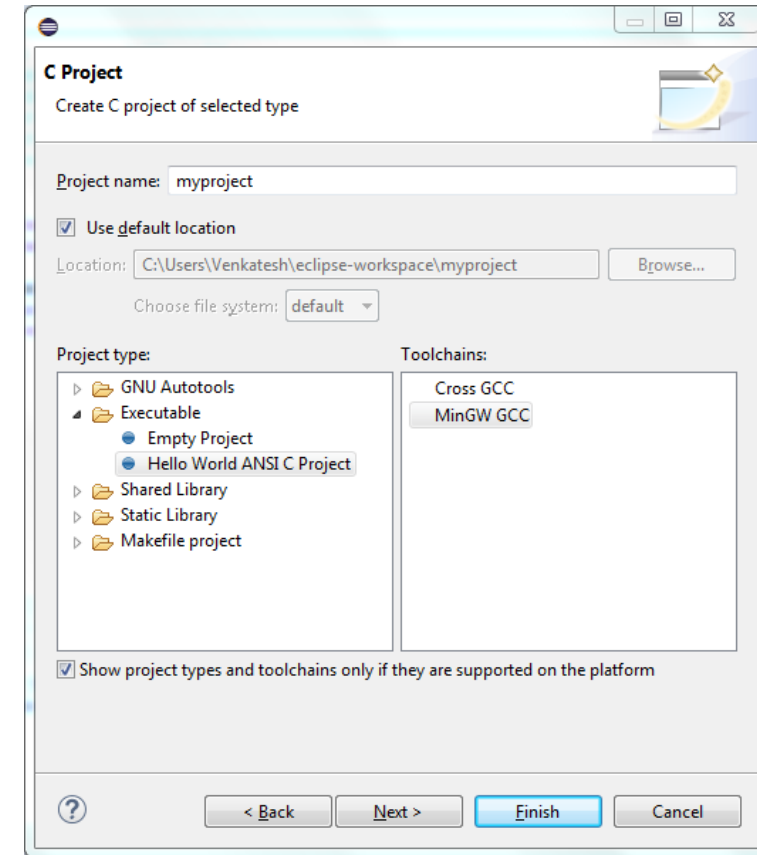
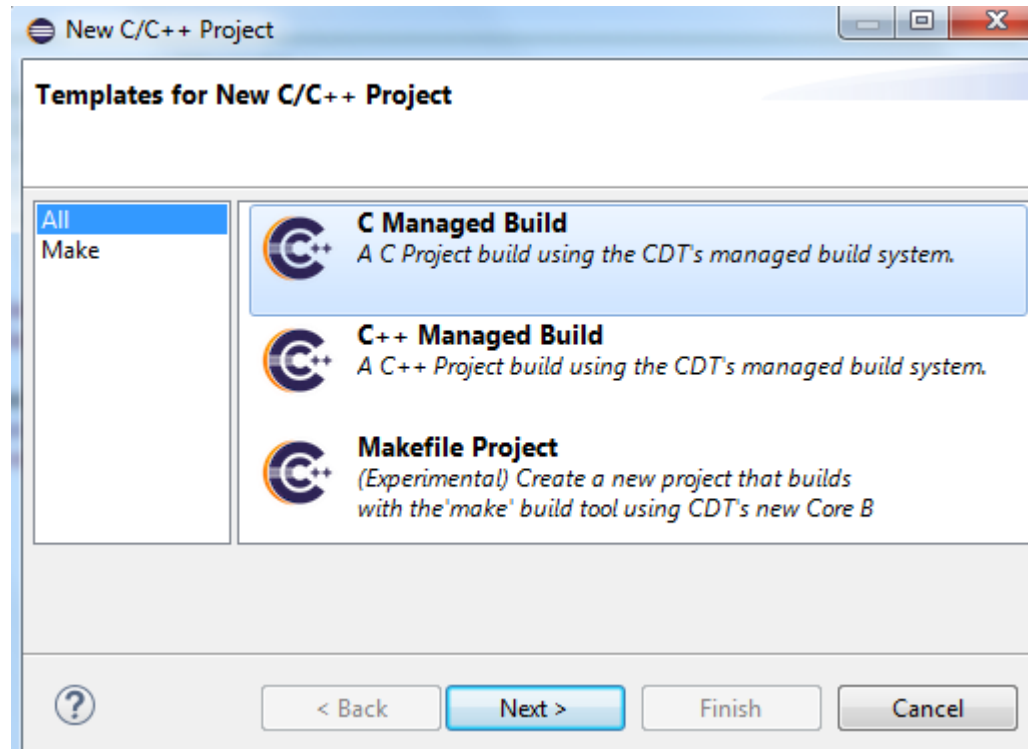
Annexure

Using Eclipse

Install Eclipse CDT and MinGW

- Linux, Windows and Mac users
 - Install the latest “Eclipse IDE for C/C++ Developers”
 - Visit <https://www.eclipse.org/downloads/packages/>
- For Windows Users
 - Install the latest “Minimalist GNU for Windows”
 - Visit <http://mingw.org/>.

Create a new C Project



Build and Run

