ENGR 1181 | MATLAB 1: Program Design

Preparation Material

Learning Objectives
1. Explain the significance of the planning stage in computer problem solving
2. Create algorithms to plan and develop code
3. Construct flow charts to plan and develop code

Topics
The following items must be completed for this preparation:
- Watch the video MAT_Structured_Problem_Solving_VIDEO_REV_20130718
- Read this document
- Complete the pre-class Algorithm described in this document

This material in this document contains the following:
1. Problem Solving Overview
2. Tools for Program Development
3. Algorithm
4. Flowcharts
5. Algorithm and Flowchart Example
6. Pre-Class Algorithm Assignment

The timestamp outline for the video:
- Get comfortable - 1:11
- Hands Off! - 5:50
- Reese's Pieces - 7:45
- Talk to Me - 9:43
- "Crystal" - 12:13
- Verify - 15:15
- End - 17:21

Total time if played at 1.5x speed: 11:34
Total time if played at 2x speed: 8:41

1. Problem Solving Overview
Engineers must analyze and solve a wide range of technical problems. They can:
- be reasonably simple single-solution problems,
- be open-ended that require a team of engineers from several disciplines,
- have no clear solution.

This class focuses on Computer Assisted Problem Solving and Programming. Computers are good tools for solving rule-based problems.
2. Tools for Program Development
A variety of tools and techniques can be used in the process of program development. They are useful for organizing the tasks in problem solving.

- Many of the tools are focused on the:
  - development or formulation of algorithms
  - representation of algorithms
  - refinement or structuring of algorithms
- Top-down design technique
  - Start with overall function and perform several step-wise refinements
- Outlining
  - Follow a top down approach to create an outline from the high level ideas down to the level of single logical actions.
- Pseudo code
  - Plain English descriptions of what a computer is to do
- Logic diagrams or flowcharts
  - Alternate representations of algorithms including graphic and state representations, logic flows

3. Algorithm
- A step-by-step plan that involves the actions to be taken and the order in which they are to occur.

4. Flowcharts
- Useful visual tool for program development
- Describes the logic flow of the program
- Not a complete description of program
- Made before writing the program
- No formal standards, but common guidelines as shown in the PowerPoint “Flowchart symbols”.

5. Algorithm and Flowchart Example
You have a bin of metal pins, and you need to determine the smallest pin available. To do this you are going to create an algorithm and flowchart to plan out the solution.

The first step is to document the assumptions and givens, then write a step by step algorithm and then create a flowchart for the process.
Assumptions/Givens:
- Bin of metal pins (at least 1)
- The person knows how to use the measuring device to measure the length accurately

Algorithm:
1. Start
2. Select a pin from the bin and measure its length
3. Set this length as the “temporary minimum value”
4. Are there still pins in the bin? If yes, go to step 5, otherwise go to step 8.
5. Select a pin from the bin and measure its length
6. Is the length less than the “temporary minimum value”? If yes, go to step 7, otherwise go to step 4.
7. Set this length as the “temporary minimum value”, go to step 4.
8. The minimum value is the “temporary minimum value”
9. End

Flowchart:

6. Pre-class Algorithm Assignment
Problem: Fill a bottle with stones

Write an algorithm to fill a bottle with stones

Make sure to document the assumptions and givens. Use the algorithm example above to help complete this.