

Tutorial One

1. Code debugging
 - a. Download and unpack the source code for this tutorial.
 - b. Open the file **calculator.cpp** and locate the 10 bugs found in the code.
Note down all the problems and edit the code to the bugs.
2. Parallel-plate capacitor: A parallel-plate capacitor has square plates of lateral dimensions 25.4cm on a side, a plate separation of 0.16mm and a vacuum between the plates.
 - a. Write a program to determine the capacitance.
 - b. Extend the program to calculate the charge on the capacitor if the potential difference across the plates is 50V.
 - c. Generalise the program to calculate the capacitance and charge of a parallel-plate capacitor whose length, width, plate separation and potential difference are entered by the user of your program.
3. Probability of tossing a coin.
 - a. Write a program to calculate the probability of tossing 8 heads from 10 throws of a coin.
 - b. Generalise the program to allow the user to find the probability of tossing i heads from j throws, where i and j are determined by the user.
4. Fibonacci sequence. The program fibonacci.cpp attempts to display the first 10 numbers in the Fibonacci sequence.
 - a. Remove the 4 bugs in the program and confirm that the first 10 numbers in the sequence are 1,1,2,3,5,8,13,21,34,55.
 - b. Improve the code by changing the variable names, applying suitable whitespace and adding comments.
 - c. Add a few statements to the program to display the sum total of the first 8 numbers in the sequence.
 - d. Modify the program to accept an input value that will decide the number of values in the sequence. Confirm that the sum total of the sequence of the first 20 Fibonacci numbers is 17710.
 - e. Run the program to calculate the sum total for the first 40 Fibonacci numbers. Confirm the correct answer of 267914295.

Notes:

- The emacs editor will automatically provide you with a helpful colour and indentation scheme if you open your source code file with the **.cpp** suffix.
- To unpack the source code contained in the file **tutorial1.tar.gz** type '**tar xvfz tutorial1.tar.gz**' at the command prompt. The source code is found in the newly created directory **tutorial1/**

Hints for Question 2:

- Before you start programming you need to find the equations for capacitance.
- Be careful with how you present the precision of the result.

Hints for Question 3:

- Find the appropriate probability distribution to use.
- You will have to calculate a factorial. Try and use a **for** loop in this calculation,
- especially in the general case.

Hints for Question 4:

- A number in the Fibonacci sequence is calculated by $F_n = F_{n-1} + F_{n-2}$.
- The amount of comments and the style of variable names is completely up to you, there is no wrong answer.
- For (d), consider the fact that every number in the sequence does not have to be stored in an array for the program to work. Is there a fixed minimum number of sequence values you can store that will allow you to define the size of the sequence only when the program is run?
- For (e), consider the type declarations for the variables in the code.