EECE 230 Introduction to Programming
Quiz I

Oct 7, 2013

- The duration of this exam is 2 hours.
- It consists of 3 problems for 100 points.
- You will have **10 minutes** at the end of the exam to **upload** your answers to the moodle website. It is your responsibility to make sure your files are correctly uploaded.
- You can use the C++ lectures and the C++ tutorial in pdf format on your lab machines.
- You are **NOT** allowed to use the **web** (**imail** included). You are not allowed to use **USB's** or files previously stored on your machine.
- If you violate the above rules or if you communicate with a person other than the exam proctors during the exam, you will immediately get zero and you will be referred to the appropriate disciplinary committee.
- Active cell phones and any other unauthorized electronic devices are absolutely not allowed in the exam rooms. They should be turned off and put away.
- Plan your time wisely. Do not spend too much time on any one problem. Read through all of them first and attack them in the order that allows you to make the most progress.
- Submit your solutions each part in a separate file as indicated in the booklet. Include your name and ID number in each file.
- Good luck!

Problem 1 (40 points). Solar system.

The annual solar energy output of a photovoltaic system is given by the formula:

$$E = S * y * R * \alpha$$

Where E is energy given in (kWh), S is the total solar panel Area given in m^2, y is the solar panel yield factor, R is the annual average solar radiation on tilted panels given in (kWh/m^2), and α is a performance ratio that compensates for losses in your power harvest and storage system. We set α by default to 0.75.

Assume $y = 15\%$ and R is $1,950$ (kWh/m^2). You have available solar panels with the following areas: $20m^2, 40m^2$, and $50m^2$.

- **Part a. (15 pts).** Compute the total energy per year for each type of the solar panels.
- **Part b. (7 pts).** Prompt the user asking about daily power consumption in **Kilo Watts per day (kWd)** for the following:
  - lighting, fridge, water pump, microwave, and television
- 8 pts. Compute the total consumption **per year**, assume the solar power should supply at least 20% of the demand, and use the above formula to recommend the smallest panel if possible.

Correct and detailed comments are worth **5 points** (only that much since the question is very detailed already). Compiling and working solutions get **32 points**. The remaining **8 points** are for style, correctness, indentation, thinking and problem solving skills.

Submit your solution in a file called Prob1.cpp including your name and ID number.

Problem 2 (40 points). Items on sale.

You are running a sale of 50% on selected items at your store. You only allow a maximum of two sale items per household.

Represent your items with an array P where $P[i]$ represents the price of item i, and where $0 \leq i < n$ where n is the number of items. Represent your sale with an array of Booleans S where $S[i]$ is $true$ when item i is on sale and $false$ otherwise.

Represent the basket of a customer with an array B that has the indices of the purchased items. That is $B[j]$ is the index of the item in array P, where $0 \leq j < m$ where m is the number of items in the basket.

- **Part a. (10 pts).** Write declaration and initialization code using the `rand` function for n, P and S. Write your initializing code so that the prices range from $2,000$ L.L. up to $150,000$ L.L. and so that 10 to 20% of the items are on sale.
- **Part b. (10 pts).** Write code that simulates customer baskets (initializes m and the array B over and over again using `rand`).
  - **(10 pts).** Compute the total cost of the items considering half the price for the items on sale and print the result.
  - **(10 pts).** If more than two sale items are present in the basket, skip the basket and issue a message requesting manager attention.

Correct and detailed comments are worth **12 points**. Compiling and working solutions get **32 points**. The remaining **8 points** are for style, correctness, indentation, thinking and problem solving skills.

Submit your solution in a file called Prob2.cpp including your name and ID number.

Problem 3 (20 points). In-order insertion.

Let a be an array of size n, and let ℓ and r ($0 \leq \ell \leq r \leq n-1$) be two indices denoting the left and right boundaries of an interesting part of the array a.

- Write code that declares and initializes the above variables.
- Write code that takes a value v from the user and checks whether v exists in a between ℓ and r. If it does, then print the index, otherwise, print -1.
- Now that you have an idea how to represent a part of an array, assume a is already in order, and provide an efficient implementation for the search problem.

Detailed and correct comments are worth **7 points**.
Submit your solution in a file called Prob3.cpp including your name and ID number.