



[You may use your textbook, course notes, and any homework problems that you have answered personally.] Show all of your work clearly in the space provided or on the additional page at the end of the exam. If the additional page is used, clearly identify to which exam question it is related. Be sure to **read each problem carefully**. You should answer all 5 questions. Note that the exam is double sided.

1. (15 points) Clearly describe the differences between a `do/while` loop and a `while` loop.

2. (15 points) Assume `i`, `j`, and `k` are `ints` and `x` is a `double`. Rewrite the following code using `if` and/or `if/else` statements instead of the `switch` statement.

```
switch(i) {
  case 3:
    cout << "1+2=" << i << endl;
    break;
  case j:
  case k:
    cout << "i is " << k << endl;
  default:
    cout << "Do you know what i is?" << endl;
}
```

3. (15 points) What will the following program display?

```
1  #include <iostream>
2  using namespace std;
3
4  int main()
5  {
6      double x = 3.8;
7      for(int i=0; i<=3; ++i) {
8          cout << i << endl;
9          for(int j=5; j<=8; ++j) {
10             cout << i << j << endl;
11         }
12         cout << i;
13         ++i;
14     }
15     return 0;
16 }
```



4. (30 points) Write a C++ program that will ask the user to “Enter as many non-negative numbers as you would like. Signify that you are done entering numbers by entering -1.” The program should then display the average of all of the numbers entered by the user.

5. (25 points) The probability that an individual telephone call will last less than t minutes can be approximated by the exponential probability function:

$$\text{probability that a call lasts less than } t \text{ minutes} = 1 - e^{-t/a}$$

where a is the average length of a call and $e = 2.71828$ (Euler's number). For example, assuming that the average call length is 2 minutes, the probability that a call lasts less than 1 minute is calculated as $1 - e^{-1/2} = 0.3297$.

Using this probability function, write a C++ program that asks the user to enter the average length of a call and displays the probabilities of a call lasting less than 1 to less than 500 minutes, in 1 minute increments.

Due to time constraints, you are not required to document your source code.



Additional work area for any problem. Clearly identify to which problem the work on this page is related.