# CSCI 135
# Midterm 1 Sample Questions

Summer 2015

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1. (a) Write a function `doMult(int x, int y)` that computes (and returns) the product of integers `x` and `y` without using the `*` (multiplication) operator or any other built-in functions (but you can use `abs()`). You may use `+` (addition) and the standard C++ control flow statements. Note that `x` and `y` can be positive or negative. Make sure your function can handle the size of the product of two integers.

   (b) Using the above function `doMult`, and without using any library functions (but you can use `abs()`), write a function `pow(int a, int b)` that computes (and returns) the power $a^b$. It should also work if `a` $\leq 0$ and/or `b` $\leq 0$.
   Make sure you return the appropriate type of variable.

2. Write a function `minMax` that takes 4 parameters, `x`, `y`, `min` and `max`, and computes the minimum and maximum between `x` and `y`. Instead of returning values, it changes the variables represented by `min` and `max` in their original locations.

3. What will be the output of the following piece of code?

```
int i = 5, j = 10;
cout << i << " " << j << endl;
if(i + 3 % 2 == 0)
{
    int i = j + 1;
    cout << i << " " << j << endl;
}
else
{
    int i = j - 1;
    cout << i << " " << j << endl;
}
cout << i << " " << j << endl;
```

4. Find the output of the following program

```
int i, j, N = 5;
for(i=1; i<N+1; i++)
{
    for(j=N-i; j>0; j--)
    {
        if(j > i)
            continue;
        cout << j  << " ";
    }
    cout << endl;
}
```

5. What will be the output of the following program?

```
#include <iostream>
using namespace std;

int i = 5, j = 1;
void foo(int&);
void foo(int, int);
void bar(int)

int main()
{
    int i = 7;
    cout << i << " " << j << endl;
    foo(i);
    cout << i << " " << j << endl;
    foo(i,j);
    cout << i << " " << j << endl;
    bar(j);
    cout << i << " " << j << endl;
    return 0;
}
void foo(int& i)
{
    i = 10;
    j = 8;
}
void foo(int i, int j)
{
    i = 4;
    j = 9;
}
void bar(int j)
{
    int i = 3;
}
```

6. Write a function `makeStr(string str1, string str2, int i, int j)` that returns a string that contains `i` occurrences of (the value of) `str1` separated by a some *separator*, followed by a separator, followed by `j` occurrences of `str2` (again, separated by some separator). The separator changes value, such that all occurrences of the separator at odd positions produce `'-'` (without quotes), and all even occurrences produce `'+'` (without quotes).

   For example,

   (a) the function call `makeStr("abc", "def", 2, 4)` would return `"abc-abc+def-def+def-def"`. Note that there is no separator after the last "def".

   (b) the function call `makeStr("abc", "def", 1, 6)` would return `"abc-def+def-def+def-def+def"`. Note that there is no separator after the last "def".

   For simplicity, assume $i > 0, j > 0$.

7. Write down the output of the following piece of code. Assume all relevent headers are included.

```
void updateValues(int& x, int y, int& z)
{
    z = 2 * x++ % y;
    y = z + 3;
}

int main()
{
    int a = 2, b = 3, c = 4;

    for(int x=0;x<4;x++)
    {
        updateValues(a, b, c);
        cout << a << " " << b << " " << c << endl;
    }

    return 0;
}
```

8. Write some code that, given a number $n$ stored in an integer variable `n`, computes the product of all numbers less than or equal to $n$ that are divisible by 2 or 3. There is no need to declare/initialize `n`, but make sure to show all other variable declarations. Also, skip #include, main(), etc.

9. In this question, you have to write a function `randStr()` that generates a random string from the alphabet {"A", "B", "C", "D"}. In other words, the random string should consist of the letters A, B, C or D in some combination. For example, `CCADBA` is random string of length 6 made from these letters. The function should take one parameter, `n`, which specifies the length of the random string, and it should return the generated string.

   For simplicity, assume $n \geq 0$. If $n = 0$, return an empty/blank string. You may also assume that `srand()` has been called in the program

10. In this question you will work with prime numbers. By definition, a number $n \geq 2$ is prime if its only divisors are 1 and $n$. (Hint: Another way to think about this is that a number $n$ is not prime if it is divisible by some number which is not 1 or $n$). Note that 1 is not a prime number.

    (a) Write a function `isPrime` that takes an integer parameter `n` and returns `true` if `n` is a prime number, and `false` otherwise. Return the appropriate value if $n$ is less than 2. You have to think of how to test whether a number is prime. (8 points)

    (b) Now in your main function, ask the user for 500 numbers, then output the sum of those that are prime (using the function you defined above). (4 points)

11. Write down the output of the following piece of code. (8 points)

```
for(int i=6;i>1;i--)
{
    for(int j=0;j<i;j++)
    {
        if( (i+j) % 3 == 0)
            continue;
        if( (i+j) % 2 == 0)
            cout << i << " ";
        else
            cout << j << " ";
    }
    cout << endl;
}
```

12. In this question you will simulate a very simple one player game played with two coins. The player starts with a score of 0. In each round, she flips both coins, and receives points according to the following criteria:

| Result | Points |
|---|---|
| Two Heads | 5 |
| One Head, One Tail | 3 |
| Two Tails | 1 |

The game stops when the *total score* of all rounds is at least $X$, where $X$ is a value decided independently. The player then records the number of rounds it took to reach this score. You have to write a function `coinGame(int X)` that simulates this game. It has one parameter `X`, which corresponds to the score $X$ that decides when the game stops. This function should return the number of rounds that the game went on for.

You may assume `srand(time(0))` has already been called in your program.

13. Write each of the following as one Boolean expression in C++. Assume each variable has already been declared and initialized.

    (a) The distance between point P with integer coordinates (`xp`, `yp`) and point Q with integer coordinates (`xq`, `yq`) is at least 5. You may use functions from the math libary.

    (b) Exactly two of `x, y, z` are true. Here, `x, y, z` are boolean variables.