CS 10, Lab 2

Conditionals

Start a new document in Word or a similar program. Include the names of both members of your team and any additional information or code as instructed below. At the end of the lab, please email your lab report to cs10labtues@gmail.com or cs10labthurs@gmail.com as appropriate with the subject line "CS10 Lab2 lastname lastname", with the last names of both members of your group.

A. DO NOT OPEN YOUR COMPUTER!!
For each of the if/elses below, put in your lab report whether you think they will print true or false. THEN (and only then!) copy-paste the code into your editor(from here: http://math.scu.edu/~linnell/labf16/lab2-ifelse.txt)and run the code. Ask a lab teacher if you have mismatches you can't explain.

```
#include <iostream>
using namespace std;
int main()
{   if(36)
        cout << "36 is true!" << endl;
    else
        cout << "36 is false!" << endl;

    if(0)
        cout << "0 is true!" << endl;
    else
        cout << "0 is false!" << endl;

    if(!5<=4+1)
        cout << "!5<=4+1 is true" <<endl;
    else
        cout << "!5<=4+1 is false" <<endl;

    if((-1)<0<1)
        cout << "-1<0<1 is true" <<endl;
    else
        cout << "-1<0<1 is false" <<endl;

    int x = 0;
    if(x=5)
        cout << "x=5 is true" <<endl;
    else
        cout << "x=5 is false" <<endl;

    bool condition;
    condition = (6<7);
    if(!(condition))
        cout << "!(6<7) is true!" << endl;
    else
        cout << "!(6<7) is false!" << endl;

    if(true || false)
        cout << "true || false is true" <<endl;
    else
        cout << "true || false is false" <<endl;
```

```
    if(true || true)
        cout << "true || true is true" <<endl;
    else
        cout << "true || true is false" <<endl;

    return 0;
}
```

B. Open your computers (both), and Install Zoom: https://it.scu.edu/hardware-software/zoom/firsttimesetup

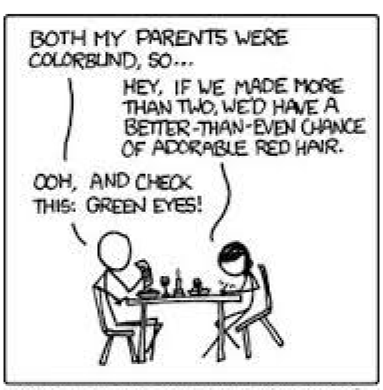
C. In your development environment, translate the following elseif C++ code into C++ code that uses a switch statement:

```
int main()
{
    char grade;
    cout<<"Enter a grade: "<<endl;
    cin>>grade;

    if (grade == 'A'){
        cout<<"Amazing job!"<<endl;
    }
    else if (grade == 'B'){
        cout<<"Great work!"<<endl;
    }
    else if (grade =='C'){
        cout<<"You pass, good job."<<endl;
    }
    else if (grade =='D'){
        cout<<"You pass, but barely"<<endl;
    }
    else if (grade =='F'){
        cout<<"You need to improve!!"<<endl;
    }
    else{
        cout<<"That is not a valid grade"<<endl;
    }
    return 0;

}
```

D. An application of if/else from biology: Punnett squares.



TRIVIA: 30% OF BIOLOGIST FIRST DATES DISINTEGRATE INTO MAKING PUNNETT SQUARES.

Punnett squares are used to help biologists understand the passing of traits from parents to offspring. For each trait, humans and other organisms carry what are called *alleles*. Which alleles a person has control how they express that trait. For instance, consider a trait of a certain kind of bean: whether the pods are yellow or green. One allele is for green pods (we abbreviate this allele G) and another allele is for yellow pods (abbreviated g). Each plant has two alleles for each trait, so this means that there are 4 possibilities of combinations of alleles in an individual plant: GG, Gg, gG, and gg (the order doesn't matter, so we usually consider Gg and gG to be the same). The combination of alleles is called the *genotype*. These genotypes are the main thing we're interested in. However, we are also interested in what color a plant with a given genotype will actually end up being; this actual physical expression of the trait is called the *phenotype* (in this case the possible phenotypes are yellow pods or green pods).

When we try to think about which genotypes map to which phenotypes, hopefully it is obvious that if a plant has genotype GG, the pods will be green – because both of its alleles are for green pods. Similarly, gg will yield yellow pods. But what about Gg? If a plant has one green allele and one yellow allele, what happens? Well, it turns out that for each trait, there is a *dominant* and a *recessive* allele. This means that if you have a mixed pair, the dominant allele wins. For our particular example, green is dominant and yellow is recessive, so Gg will yield green pods. We generally abbreviate the dominant allele with a capital letter and the recessive allele with a lowercase letter.

OK, so why do we care about the difference between GG and Gg if they both produce green pods? The answer is offspring. If I cross two bean plants, each parent will contribute one allele to the offspring. So the genotypes of the parents control the genotypes of the offspring, and thus its phenotype (in this case, its color). But since the parent has two alleles (say Bb), and will only pass along one to the offspring, there's a 50%-50% chance they will pass along each one (that is, a 50% chance they'll pass along B, and a 50% chance they'll pass along b). We can use Punnett squares to model this process.

For instance, if one parent has genotype Gg and the other has genotype GG, we write GG along the top of the square and Gg along the side of the square (which goes in which spot doesn't matter), and use this to generate the possible offspring:

	G	G
G	GG	GG
g	Gg	Gg

Since all four possibilities for offspring are equally likely, each spot in the Punnett square contributes 25% probability. Since there are two Gg spots and two GG spots, there is a 50% chance that the offspring will have genotype Gg, and a 50% chance the offspring with have genotype GG.

1. PUT AWAY YOUR LAPTOPS. How many different possible Punnet squares are there? That is, what are the possibilities for different combinations of maternal and paternal genotypes? (remember, we treat Gg and gG as the same). Get your paper signed before moving on.
2. Draw out all possible Punnet squares. For each one, write out the resulting percentage probabilities for GG, Gg, and gg. Get your paper signed before moving on.
3. Write pseudocode ON PAPER that prompts the user to enter the genotypes for the two parents, and then applies appropriate if statements to determine which Punnet square applies to that combination of genotypes. It should print out the resulting percentage probabilities for GG, Gg, and gg. Have your paper signed before moving on.
4. TAKE OUT YOUR LAPTOPS. Translate your pseudocode from question 3 into c++ code. Copy-paste your code into your lab report. Run your code with several outputs to be sure it's right before moving on.

----------------------MINIMUM STOPPING POINT---------------------------------

5. Create a NEW C++ project, and copy-paste over your code from 4. Change the code so that now it prints out the percentages for resulting phenotype. Look for opportunities to simplify your code (that is, ways to reduce the number of if/elses in your code). Get your paper signed before moving on.

E. A Return to Punnett Squares The pseudocode below gives an alternate solution to the problem solved in part C. Read and the pseudocode below, and convince yourself it will have the same output as your solution to part C. In your lab report, write a few sentences explaining which solution you think is better, and why.

```
gg = 0
Gg = 0
GG = 0
m1 = input()
m2 = input()
p1 = input()
p2 = input()
if m1=="G" and p1=="G":
   GG = GG+.25
else if (m1 == "G" and p1 == "g") or (m1 == "g" and p1 == "G"):
   Gg = Gg+.25
else if m1 == "g" and p1 == "g":
   gg = gg+.25

if m2=="G" and p1=="G":
   GG = GG+.25
else if (m2 == "G" and p1 == "g") or (m2 == "g" and p1 == "G"):
   Gg = Gg+.25
else if m2 == "g" and p1 == "g":
   gg = gg+.25

if m1=="G" and p2=="G":
   GG = GG+.25
else if (m1 == "G" and p2 == "g") or (m1 == "g" and p2 == "G"):
   Gg = Gg+.25
else if m1 == "g" and p2 == "g":
   gg = gg+.25

if m2=="G" and p2=="G":
   GG = GG+.25
else if (m2 == "G" and p2 == "g") or (m2 == "g" and p2 == "G"):
   Gg = Gg+.25
else if m2 == "g" and p2 == "g":
   gg = gg+.25

print("GG: ")
print(GG)
print("Gg: ")
print(Gg)
print("gg: ")
print(gg)
```