ECE 468 & 573
Problem Set 5: Loop transformations

Loop transformations
For the following problems, consider the code below:

```
1.   X = 2;
2.   Y = 10;
3.   Y = X * Y;
4.   A = Y * X - 2 * Y;
5.   B = X / 2 + Y;
6.   Z = 10;
7.   if (B < Z) goto 12
8.   D = Y - Z * 3;
9.   Q = Y - 8;
10.  Z = Z - Q;
11.  goto 7;
12.  X = X + Y;
13.  if (X < Z*100) goto 4;
14.  Y = D;
15.  halt;
```

1. Draw the CFG for the code above. Identify the loops in the code.

2. Which statements are loop invariant? Can they be moved outside their enclosing loop? Show the code that results after hoisting any loop invariant code outside the loop.

3. Identify the induction variables in this code. Show the code that results after performing any possible strength reduction.

4. Show the code after performing any possible linear test replacement.

5. Give an example of a piece of code with a doubly-nested loop where loop *interchange* is *not legal*.