Spring 2020 **CSC 419 - Programming Languages - Assignment 4**

Due date: Thursday, March 19, 2020, before midnight, upload in home folder of class

a) What is side effects in programming languages?
[3 points]

b) Write code in Python that demonstrates two different ways to get side effects in a function (i.e., write two functions, each showing a different way of getting a side effect). Consider ways to get side effects in terms of the scope of the variable and issues of mutability. Call the functions and run the code, showing the side effects.
[10 points]

c) Let the function fun be defined as:

```
int fun(int *k) {
   *k += 4;
   return 3 * (*k) - 1;
}
```

Suppose fun is used in a program as follows:

```
int main() {
   int i = 10, j = 10, sum1, sum2;
   sum1 = (i / 2) + fun (&i);
   sum2 = fun(&j) + (j / 2);
   return 0;
}
```

What are the values of sum1 and sum2

1) if the operands in the expressions are evaluated left to right?
2) if the operands in the expressions are evaluated right to left?

[4 points]

d) Run the code given above on some system that supports C to determine the values of sum1 and sum2. Explain the results. Take into account the original design of order of evaluation in the C language (versus, for instance, the design of order evaluation in Java).

[3 points; +2 points extra credit: Can you find an older compiler for C that has a different answer? Even if you can’t, note what compilers you tried.]