Exercise 1: Optimization pitfalls in C  
10 Points

For the following examples, say if the optimization is correct or not. State your assumptions if you think it is correct or give a reason why it could be incorrect. A few words is enough!

Assumptions:

- C11 language standard (in case you want to be thorough...)
- no multi-threading
- the rest of the program could be anything, but contains no errors or undefined behavior
- all variables are read at the end of the program
- reading uninitialized variables does not result in undefined behavior (no trap representations, not in register)
- programs containing undefined behavior can be replaced by anything

1.

```c
int a;
a = f();
a = 0;
```

2.

```c
int a;
a = 0;
if(a){
    f();
}else{
    g();
}
```

3.
Exercise 2: Simple imperative language, CFG, state

Consider the following program code.
int r = 0;
for (int i=0; i<n; i++)
        r += a[i] * a[i];

a) Translate the program to our simplified imperative language (don’t compute the index in an extra register for loads).
b) Draw the corresponding Control Flow Graph.
c) Write down the path (π = ...) that represents the computation of the program with n = 1.
d) Give the states for the first 4 target nodes and the last node of the path with the starting state $s_0 = (\rho, \mu) = (\{A_0 \mapsto 0, n \mapsto 3\}, \{0 \mapsto 2, 1 \mapsto 3, 2 \mapsto 4\})$. 