hw1 weakest precondition calculus and loops

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**Question 1**

**Post condition**

Q=(0≤y)∧(0≤x⇒y=x)∧(x<0⇒y=−x)

**If else B=(x<0)**

WP(if B then S1​ else S2​,Q)=(B⇒WP(S1​,Q))∧(¬B⇒WP(S2​,Q))

**Substitute**

((x<0)⇒(0≤-x)∧(0≤x⇒-x=x)∧(x<0⇒-x=−x))

∧((0≤x)⇒(0≤x)∧(0≤x⇒x=x)∧(x<0⇒x=−x))

**Simplify**

((x<0)⇒(x≤0)∧(0≤x⇒−x=x)∧(x<0⇒−x=−x))

∧((0≤x)⇒(0≤x)∧(0≤x⇒x=x)∧(x<0⇒x=−x))

**TRUE**

Question 2

Part 1

**Post condition**

Q= big>small

**If else x>y**

WP(if B then S1​ else S2​,Q)=(B⇒WP(S1​,Q))∧(¬B⇒WP(S2​,Q))

**Substitute {big, small := x, y} in the then and {big, small := y, x;} in the else**

((x>y) ⇒(x>y))

∧((x≤y) ⇒(y>x))

**The precondition fails because (x≤y) can be true at the same time that (y>x) is false**

So x != y ==> wp(S,Q)

Part 2

A screen shot of a computer program

Description automatically generated

**Question 3**

Part A

Post condition

Res = n0 \* m0

Loop invariant

I: res + n \* m == n0 \* m0

A computer screen shot of a program

Description automatically generated

Part B