Loop Invariants


```
s = 0;
for i := 1 to n do
        s = s + a[i];
```

What is the ‘loop invariant’?

s is the sum of elements from a[1] to a[i] immediately before i is incremented!

Weakest Precondition for While Statement
{P} while B do S {Q}

- Let W be while B do S
- condition for termination of the loop

  $P_0 \equiv$ (not B)

  $P_1 \equiv$ B and wp(S,P_0) $\equiv$ wp(S, not B)

  $P_k \equiv$ B and wp(S, P_{k-1})
- wp(W, true) $\equiv$ wp(W, not B) $\equiv \exists(k: k \geq 0: P_k)$

Weakest Precondition for While Statement

while B do S

The invariant condition

{I} while B do S {I and not B}

```
a = 0;
i = 0;
while (i < N)
        a = a + i++;
```

Loop Invariant: a = $\sum_{i=0}^{N-1} i$

Quiz 2

- wp(if x>2 then y:=1 else y:=-1, (y > 0))
  - wp(x:=x+2; y:=y-2, (x+y = 0))
- Find the Precondition of following
  - WP(if a<X and a>Y then Swap(), X=Y0 and Y=X0

Quiz 2

- WP(k:=5; x:=2*y; y:=x-4, w*y = z+x)
- WP(if x is even then x:= x+1, x not % 2)
- Find the pre condition for following.
  - WP(if a>x Swap(),(X=Y0 and Y=X0))