Einstaklingsverkefni 2: Forritunarmál 304G

```
function SumInts(k: int): int
requires k >= 0
{
if k == 0 then 0 else SumInts(k - 1) + k
}
method SumIntsLoop(k: int) returns (s: int)
requires k >= 0
ensures s == (k + 1) * k / 2
ensures s == SumInts(k)
{
var i := 0;
s := 0;
while i < k
invariant 0 <= i <= k
decreases k - i
invariant s == i * (i + 1) / 2
invariant s == SumInts(i)
{
s := s + i + 1;
i := i + 1;
}
}
method SumIntsRecursive(k: int) returns (s: int)
requires k >= 0
ensures s == (k + 1) * k / 2
ensures s == SumInts(k)
{
if (k == 0)
{return 0; }
else
{
var result := SumIntsRecursive(k - 1);
return result + k;
}
}
method SumIntsTailRecursive(i: int, r: int, k: int) returns (s: int)
requires 0 <= i <= k
decreases k - i
requires r == (i+1)*i/2
requires r == SumInts(i)
ensures s == (k + 1) * k / 2
ensures s == SumInts(k)
{
if (i == k)
{return r;}
else
{
var nexti := i + 1;
var nextr := r + nexti;
var result := SumIntsTailRecursive(nexti, nextr, k);
```

```
    return result;
  }
}
method Main()
{
var s1 := SumIntsLoop(5);
var s2 := SumIntsRecursive(5);
var s3 := SumIntsTailRecursive(0,0,5);
var s4 := SumIntsTailRecursive(4,10,5);
print s1;
print s2;
print s3;
print s4;
}
```