



TÖL 203 Algorithms, Logic and Complexity - PROJECT

LOOP (PROGRAMMING LANGUAGE)



Primitive recursive functions

- ▶ Subset of the total μ -recursive functions
- ▶ Most functions are Primitive recursive functions
- ▶ Basic Primitive Functions
 - ▶ Constant Function – $\text{const}_n(x) = n$, for all x
 - ▶ Successor Function – $s(0) = s(0')$
 - ▶ Identity Function (Projection Function) – $\text{id}_1^2(x,y) = x$; $\text{id}_2^2(x,y) = y$
- ▶ Operation rules
 - ▶ Composition: Given f , a k -ary primitive recursive function, and k m -ary primitive recursive functions g_1, \dots, g_k , the composition of f with g_1, \dots, g_k , i.e. the m -ary function is primitive recursive.
 - ▶ Primitive recursion: Given f , a k -ary primitive recursive function, and g , a $(k+2)$ -ary primitive recursive function, the $(k+1)$ -ary function h is defined as the primitive recursion of f and g , i.e. the function h is primitive recursive when $h(0, x_1, \dots, x_k) = f(x_1, \dots, x_k)$ and $h(S(y), x_1, \dots, x_k) = g(y, h(y, x_1, \dots, x_k), x_1, \dots, x_k)$

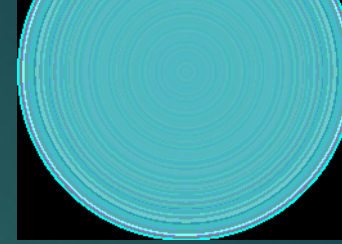
LOOP – Basic Statements

- ▶ $X_i := X_j + C$ or $X_i := X_i + C$
- ▶ $X_i := X_j - C$ or $X_i := X_j - C$
- ▶ LOOP X_i DO <statements> END
- ▶ $\text{Function}_1; \text{Function}_2, \dots, \text{Function}_n$ – Execute functions from left to right.
- ▶ Start_func <name> [(Params)] <Statements> end_func

Loopee

- ▶ An interpreter for LOOP written in Python
- ▶ Only allows addition with constants
- ▶ Following does not work:

```
start_func minus(x,y)
  out = x
  loop y
    out = out - 1
  end
end_func
```



Loopee - Cont

▶ Subtraction that works:

▶ #returns x minus y

```
start_func minus(x,y)
```

```
  out = x
```

```
  loop y
```

```
    a = 0
```

```
    loop out
```

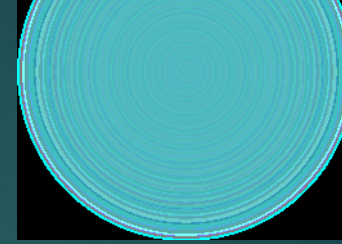
```
      out = a
```

```
      a = a + 1
```

```
    end
```

```
  end
```

```
end_func
```



Loopee - Cont

- ▶ For more information see:
- ▶ <http://people.csail.mit.edu/meyer/meyer-ritchie.pdf>
- ▶ http://en.wikipedia.org/wiki/Primitive_recursive_function

