Introduction to Algorithms Lecture 4

By: Darmen Kariboz

Outline

- Polish Notation
- Horse move
- Array increase

Simple math notation => 3 + 6 – 24 * 2
Polish notation => – + 3 6 * 24 2
Reverse Polish notation => 3 6 + 24 2 * –

Polish notation

The Polish logician Jan Łukasiewicz invented this notation around 1920 in order to simplify sentential logic.

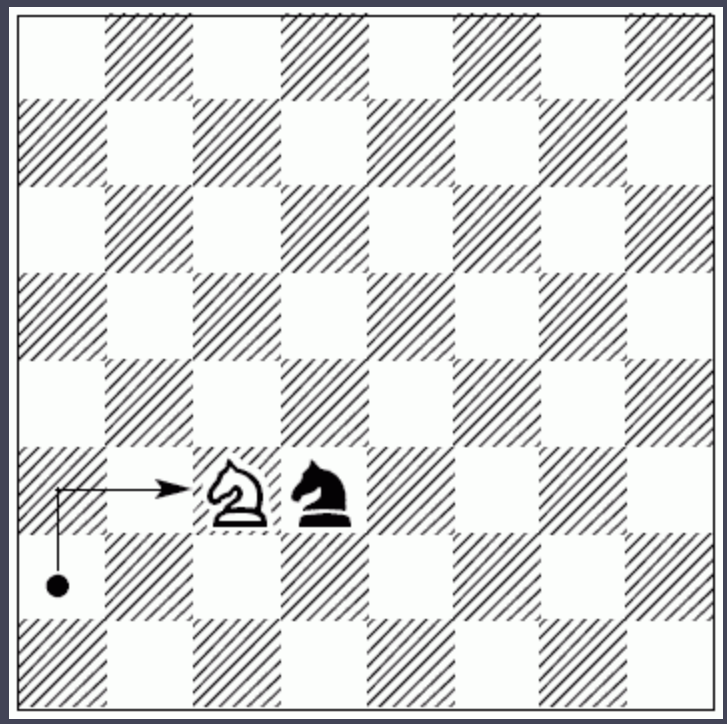
Shunting-yard algorithm (to RPN)

1. **while** more tokens do
2. **if** token is number then
3. output number
4. **if** token is operator then
5. **while** higher **OR** EQUAL priority operators in stack **do**
6. output top operator
7. put operator to stack
8. **while** any operators in stack
9. output top operator

Reverse Polish Notation algorithm

- **while** more tokens **do**
- **if** token is value **then**
- push value to stack
- **if** token is operator **then**
- **pop** two values X then Y
- res = Y operator X
- **push** res to stack
- **output** alone value from stack.

Move Knight



Move white Knight to position of black Knight, by minimum moves.

BFS – with queue

- x,y ← initial position
- m.n ← destination position
- Queue ← (x,y)
- A[x,y] = 1
- **while** Queue has elements **and** A[n,m] = 0 **do**
- (x,y) ← dequeue from Queue
- **for** each possible Knight move (i,j) **do**
- **if** A[i,j] = 0 **then**
- A[i,j] = A[x,y]+1
- Queue ← (i,j)
- **if** A[n,m] > 0 **then**
- Output “Knight moved in ”+(A[n,m]-1) + “ steps”
- else Output “No Solution”

Increase array

In one iteration it is needed to change all numbers to next bigger value, or to 0 if there are no bigger values.

Sample input	Sample output
1 3 2 5 3 4	3 5 5 0 4 0

Solution

- **For** i =1 to length(A) **do**
- **while** size(Stack)>0 **and** A[top of Stack] < A[i] **do**
- x ← pop from Stack
- A[x] = A[i]
- Stack ← push **i**

- **while** size(Stack)>0 **do**
- x ← pop from Stack
- A[x] = 0

Home Work

- **Reverse Polish Notation**
- Realize RPN

- **Horse move**
- Realize Knight problem

- **Increase Array**
- Realize increase array algorithm

Pop-up Quiz 1

- 1. What happens when you try to sort an already sorted array with insertion sort?
- 2. Which implementations of Queue do you know?