Practice 1 report

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Abstract

Introducction to Turing Machines and RAM Model, with two examples of problems that will be solved, analiced and compared.

Methodology

- Utilization of Turing Machine Simulator.
  - Developed at Princeton University.
  - Run over java.
- Utilization of RAM Model simulator design by the teacher.
- We will develop the solution for two problems, according to the simulator.
- Then, the solutions we'll be analiced.
- Another solutions we'll be design using the ram model tools provided
- To conclude, they'll be compared through Cobham thesis.

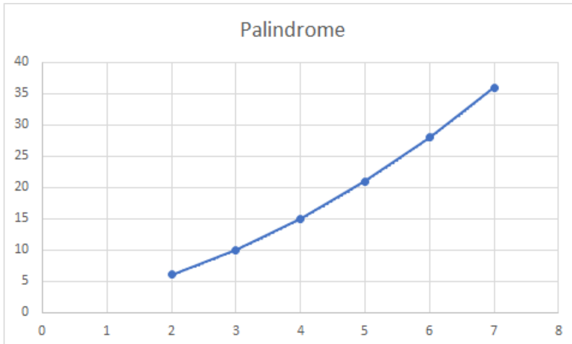
Result and discussions

To count steps in both ram problem implementations, I modified the file given "ram.h" with a counter for every operation admited.

Palindrome problem

Turing Machine

I build a machine with only eight states that can solve the problem, using an alphabet of two characters, {0,1}'s.



As we can see, for several input length values, between one and ten, the graphics, fits perfectly at a polynomial grade two function.

The number of steps taken by every execution for $1 \leq n \leq 10$ are:

input length	steps
1	3
2	6
3	10
4	15
5	21
6	28
7	36
8	45
9	55
10	66

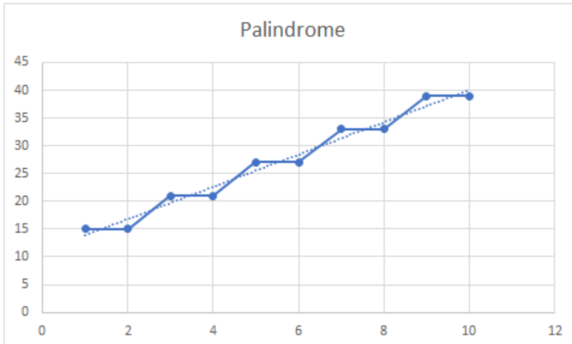
Ram Model

For ram model implementation I created a program with seven labels, that use eight registers to solve if any input string is a palindrome.

For input strings between $1 \leq n \leq 10$ it takes:

input length	steps
1	15
2	15
3	21
4	21
5	27
6	27
7	33
8	33
9	39
10	39

As we can see, results follow a clear pattern, increasing it number of steps by six every time we increase the input length two units. In this ocassion, the function does not fit perfectly any curve.

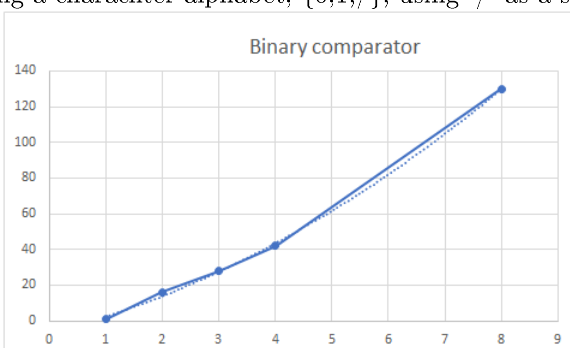


Binary comparator problem

For this problem, input length is duplicated, due to the need of two binary numbers to compare. This is taken in account during the analysis.

Turing Machine

This time I build a machine with sixteen states that can solve the problem, using a charachter alphabet, {0,1,/}, using '/' as a separator of strings.



In this ocassion the model fits too with a polynomial grade 2 function, for inputs length values between one and ten.

The number of steps taken by every execution for $1 \leq n \leq 10$ are:

input length	steps
1	8
2	16
3	28
4	42
5	60
6	80
7	104
8	130
9	160
10	192

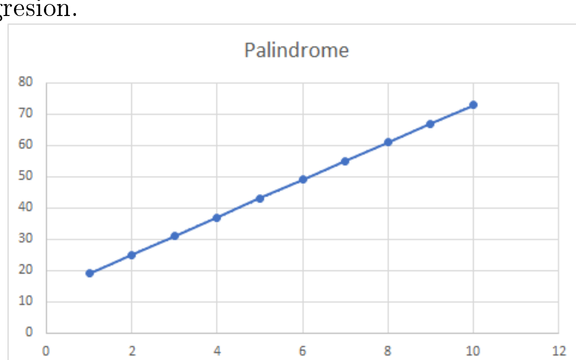
Ram Model

To build a RAM model implementation of this problem I needed eight labels with eight memory registers.

For input strings between $1 \leq n \leq 10$ it takes:

input length	steps
1	19
2	25
3	31
4	37
5	43
6	49
7	55
8	61
9	67
10	73

Its fair to say that the number of steps taken by the algorithm fits a linear regresion.



Conclusions

In both cases RAM Model, appear to be more effective, having less execution steps for high values of input length, however, for low values, Turing machine seems to be more eficient.

Also, as can be checked, both problems can be solved in polynomial time, so they both fulfill Cobham thesis requeriments.