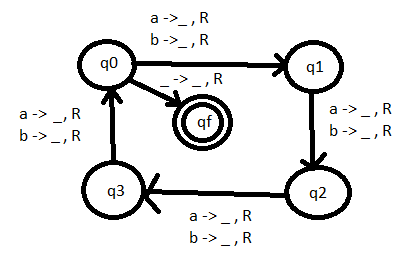
CSci 435: Formal Languages and Automata

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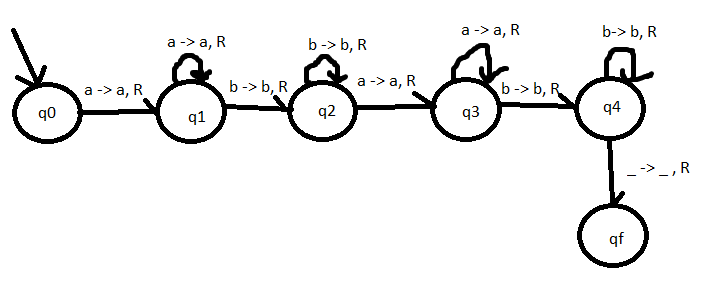
**Home Assignment 7: 120 points + 25 points (optional)**

Q1. [20] For a given language below, construct a TM with a *single final state* that accepts it.

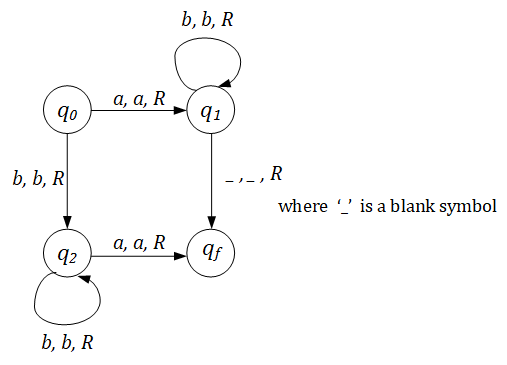
1. [6] L = {w ||*w*|is a multiple of 4} where Σ = {*a*, *b*}.



1. [7] L = {w | *na*(*w*) ≠ *nb*(*w*)} where Σ = {*a*, *b*}.
2. [7] L = {w | *anbn anbn* | *n* ≠ 0} where Σ = {*a, b*}.



Q2. [10] What language is accepted by the Turning machine whose transition graph is in the figure?

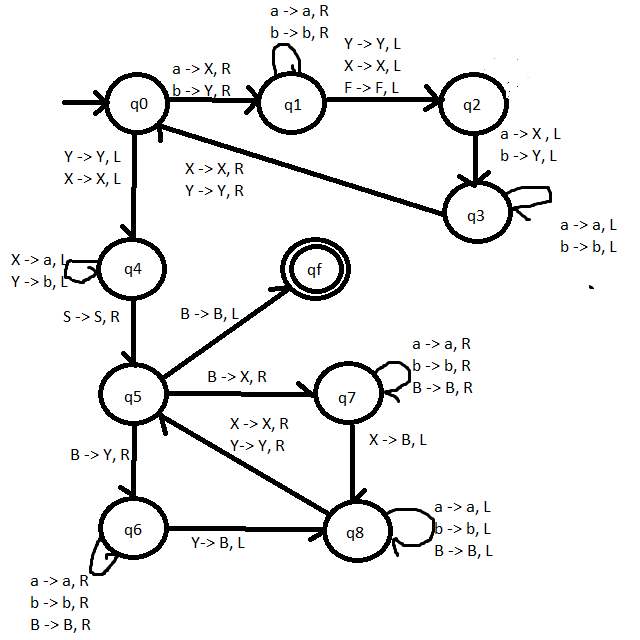


L = {w | ab\* + bb\*a}

Q3. [10] Construct a TM that accepts L = {ww | w ∈ {*a, b*}+ }.

Hint: This is a standard deterministic TM.

So, TM has to **find** the middle of the string first; then, compare two halves.



Q4. [20] Construct a TM that computes the following function

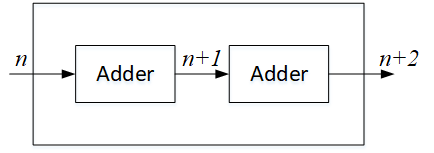
1. [10] .

The input *w* is in the unary representation.

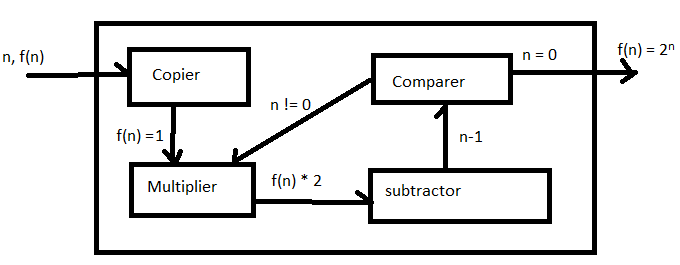
1. [10] *f* (*x, y*) = *x* + 2*y.*

Q5. [20] Using adders, subtracters, comparers, copiers or multipliers, draw block diagram for TM that compute the functions:

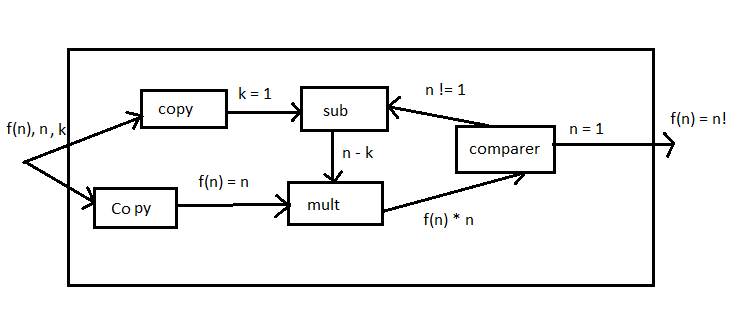
e.g.) *f*(*n*) = *n* + 2



1. [10]*f*(*n*) = *2n.*



1. [10] *f(n) = n!*



Q6. [15] For a two-tape Turing Machine,

1. [5] Give a *formal definition* of a transition function δ in two-tape TM.
2. [10] Construct a two-tape TM that accepts L = { *anbn cn* | *n* ≥ 1}

Q7.[15, optional] Construct a **Nondeterministic** TM (NTM) that accepts L ={ *wwRw* | *w* ∈ {*a, b*}+ }.

1. Draw its transition graph, (B) explain how your transitions work out and (C) how the nondeterministic simplifies the case.

Note that the middle of the string in wwR can be guessed in NTM.

Q8. [10] Give the encoding, using the suggested method in the slide of Chap.9-#25-#27, for

δ(*q1, a1*) = (*q1, a1*, R); δ(*q1, a2*) = (*q3, a1*, L); δ(*q3, a1*) = (*q2, a2*, L)

Q9. [5] If *a* is encoded as 1, *b* as 11, R as 1, L as 11, decode the string 011010111011010.

String : 011010111011010 ->

Q10. [10, optional] Describe an algorithm that examines a string in {0, 1}+ to determine whether or not it represents an encoded Turing Machine.

Q11. [10] Describe how Linear Bounded Automata could be constructed to accept

L = { *an* | *n* is a prime number}.