CS 321H Activity 6

Submit to Canvas a pdf file containing verbal explanations and transition graphs for the Turing machines and the .jff files

1. Design single-tape Turing machines that accept the following languages using JFLAP

a) $L = \{ w : n_a(w) = n_b(w) = n_c(w) : w \in \{a, b, c\}^+ \}$.

Test case	Result
abc	accept
bca	accept
babacc	accept
cacacabbb	accept
abba	reject
abcc	reject
babac	reject

2. Design Turing Machines using JFLAP to compute the following functions for x and y positive integers represented in unary and separated by a "0" on the input tape. The value $f(x,y)$ represented in unary should be on the tape surrounded by blanks after the calculation.

$f(x, y) = x + 2y$

Input	Output	Result
1101	1111	Accept
101	111	Accept
11101	11111	Accept
101111	111111111	Accept
1111011	11111111	Accept

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a) $f(x) = x \; mod \; 5$

Input	Output	Result
1	1	Accept
1111	1111	Accept
11111	0	Accept
1111111	11	Accept
1111111111	0	Accept
11111111111	1	Accept

3. *(5 pts)* The nor of two languages is defined below:

nor(L_1, L_2) = { w: w $\notin L_1$ and w $\notin L_2$}.

Prove that recursive languages are closed under the nor operation.

4. *(5 pts)* Suppose we make the requirement that a Turing machine can only halt in a final state, that is, we require that δ(q,a) be defined for all pairs (q,a) with q $\notin$ F and a $\in \Gamma$. Does this restrict the power of the Turing machine? Prove your answer.