CSCI338 HW4

Brock Ellefson

March 26, 2017

Question 1

Let β be the set of all infinite sequences over $\{a,b\}$. Show that β is uncountable, using a proof by diagonalization.
Assume that β is countable, then we can list them as β_1 β_1

i	f(i)		
1	b_{11}	b_{12}	b_{13}
2	b_{21}	b_{22}	b_{23}
3	b_{31}	b_{32}	b_{33}

Now construct an x such that the i^{th} bit of x is $\neq$ the i^{th} bit of β

i	f(i)		
1	0	0	0...
2	1	0	1...
3	1	1	1...

Lets define x as x = (1, 1, 0...) thus making x $\neq \beta$ for any i^{th} sequence in the i^{th} bit. Therefore β is uncountable.

Question 2

Question 3

Question 4

Question 5

Show that EQ_{CFG} is undecidable.
Assume that EQ_{CFG} is decideable
$EQ_{CFG} = \{ <G,H> \mid G,H \text{ are CFG's and } L(G) = L(H) \}$
Reduce ALL_{CFG} to EQ_{CFG} Such That:
$ALL_{CFG} = \{ <G> \mid G \text{ is a CFG's and } L(G) = \Sigma^* \}$
Let R be a decider for EQ_{CFG} and construct TM S to decide ALL_{CFG}.
Construct CFG T such that $L(T) = \Sigma^*$

1. Run R on input $<G,T_0>$

2. If R accepts, accept.
3. If R rejects, reject

R decides if L(G) = L(T). S decides ALL_{CFG} but it is undecidable, therefore EQ_{CFG} must also be undecidable

Question 6

Question 7