Assignment # 5 Sample

1. For each of the following, prove it is not regular by using the Pumping Lemma or Myhill-Nerode. You must do at least one of these using the Pumping Lemma and at least one using Myhill-Nerode.

a. $\{ a^{2^k+1} \mid k \geq 0 \}$ (note: 2^k+1, so get $\{a^2, a^3, a^5, a^9, a^{17}, \ldots \}$)
b. $\{ a^i b^j c^k \mid i \geq 0, j \geq 0, k \geq 0,$ if $i=0$ then $j=2k \}$
c. $\{ xyz \mid x,y,z \in \{a, b\}^*$ and $y = xz \}$

2. Write a regular (right linear) grammar that generates the set of strings denoted by the regular expression $(((01 + 10)^+)(11))^* (00)^*$. You may use extended grammars where rules are of form $\mathbf{A} \rightarrow \alpha$ and $\mathbf{A} \rightarrow \alpha\, \mathbf{B}$, $\alpha \in \Sigma^*$ and **A**,**B** non-terminals

3. Write a Mealy finite state machine that produces the 2's complement result of subtracting 1101 from a binary input stream (assuming at least 3 bits of input)