

**Week 11 Tutorial Session**

- (1) Show that the following languages are decidable.
- (a)  $L_1 = \{\langle R \rangle \mid R \text{ generates at least one string } w \text{ that has } 111 \text{ as a substring}\}$   
Here  $R$  is a regular expression over alphabet  $\{0, 1\}$ .
  - (b)  $E_{\text{CFG}} = \{\langle G \rangle \mid \text{Context-free grammar } G \text{ generates no strings } (L(G) = \emptyset)\}$
- (2) For each of these languages, say whether it is decidable. Justify your answer.
- (a)  $L_1 = \{\langle M, w, t \rangle \mid \text{Turing machine } M \text{ accepts } w \text{ within } t \text{ transitions}\}$
  - (b)  $L_2 = \{\langle M \rangle \mid \text{Turing machine } M \text{ accepts all inputs of odd length (and nothing else)}\}$