2) Proof L is a non regular language using the Pumping lemma:

a) $L = \{w \in \{0,1\}^* : w = 0^{n!},\ n \geq 0\}$

b) $L = \{w \in \{0,1\}^* : w = 0^a 1^b 1^c 0^d$, where $a + b = c + d$ and $a, b, c, d \geq 0\}$ [Be careful for (b): check if xyyz works]

c) $L = \{w \in \Sigma^* : w = a^i b^j$, where $i > j$, and $j \geq 0\}$

ii) Given the Context-Free Grammar, answer the following questions:

$$A \rightarrow 1A \mid 1C \mid 0B \mid 00A$$
$$B \rightarrow 0A \mid 1B \mid 00B$$
$$C \rightarrow 0C0 \mid 0C1 \mid 1C0 \mid 1C1 \mid \varepsilon$$

(a) Give a leftmost derivation for the string 01011001. (3 points)
(b) Sketch the parse tree corresponding to the derivation you gave in (a). (2 points)
(c) Demonstrate that the given grammar is ambiguous by showing two more parse trees (apart from the one you already found in (b)) for the same string. (3 points)
(d) Find a string w of length six such that w has exactly one parse tree in the grammar above. (1 point)
(e) Design an unambiguous Context Free Grammar for the language represented by the given ambiguous grammar. (1 point)