ECE 468
Problem Set 2: Context-free Grammars, LL(1) Parsers

1. For the following sub-problems, consider the following context-free grammar:

$$
\begin{aligned}
S &\rightarrow A\$ && (1)\\
A &\rightarrow xAx && (2)\\
A &\rightarrow C && (3)\\
B &\rightarrow yBy && (4)\\
B &\rightarrow C && (5)\\
C &\rightarrow zBz && (6)\\
C &\rightarrow wAw && (7)\\
C &\rightarrow \lambda && (8)
\end{aligned}
$$

   (a) What are the terminals and non-terminals of this grammar?
   (b) Show the derivation of the string $xzzx\$$ starting from S (specify which production you used at each step), and give the parse tree according to that derivation.
   (c) Give the first and follow sets for each of the non-terminals of the grammar.
   (d) What are the predict sets for each production?
   (e) Give the parse table for the grammar. Is this an LL(1) grammar? Why or why not?
   (f) Show the steps your parser would take to parse "xzyyzx$".

2. for the following sub-problems, consider the following grammar:

$$
\begin{aligned}
S &\rightarrow AB\$ && (1)\\
A &\rightarrow xA && (2)\\
A &\rightarrow B && (3)\\
B &\rightarrow yzB && (4)\\
B &\rightarrow z && (5)
\end{aligned}
$$

   (a) What are the terminals and non-terminals of this grammar?
   (b) Show the parse tree for $xyzzz\$$.
   (c) What are the first and follow sets for each of the non-terminals of the grammar?
   (d) What are the predict sets for each production?
   (e) Give the parse table for this grammar. Is this an LL(1) grammar?
   (f) If we add the rule $A \rightarrow \lambda$, is the grammar still LL(1)? Why or why not?