1. [10 points] Is $C_4$ an $LL(1)$ grammar? Justify.

2. [5 points] Compute FOLLOW of $S$.

3. [5 points] Compute FIRST of $S$.

4. [Total 20 points] Consider the following grammar $G$: If the other characters unchanged. You need not translate the first sentence in the file. Write a (Perl) script to translate an input file to output a file containing the translated text. Assume that library functions translate lower-case to upper-case (and return non-alphabetic characters unaltered). Also assume that there is a library function that returns one of more white space characters (tabs or newlines). Write a (Perl) script to implement Capitalize. Do not write a complete program. Assume that every sentence ends with a period (.), and sentences may be separated by one or more white space characters (blanks, tabs or newlines). A library function that translates lower-case to upper-case (and returns non-alphabetic characters unaltered). Also assume that there is a library function that returns one of more white space characters (tabs or newlines). Write a (Perl) script to implement Capitalize. Do not write a complete program. Assume that every sentence ends with a period (.), and sentences may be separated by one or more white space characters (blanks, tabs or newlines). A library function that translates lower-case to upper-case (and returns non-alphabetic characters unaltered). Also assume that there is a library function that returns one of more white space characters (tabs or newlines).

2. [Total 10 points] Let $L_2$ be the set of all bit strings (i.e., strings over alphabet $\{0, 1\}$) that are divisible by 4. Give an NFA that recognizes strings in $L_2$.

3. [Total 20 points] We want to write a script that recognizes that copies a text file from stdin to stdout, replacing every lowercase letter at the beginning of a sentence with the corresponding uppercase letter. Write specifications to implement the script. DO NOT WRITE A PROGRAM.

3. [Total 20 points] Consider the following grammar $G$:

   $S \rightarrow S\text{aa} \mid S\text{ab} \mid \epsilon$

   a. [5 points] Compute FIRST of $S$.

   b. [5 points] Compute FOLLOW of $S$.

Consider the following grammar $G$:

\[
S \rightarrow \text{if Expr then } S \text{ else } S
\]

\[
S \rightarrow \text{Expr}
\]

\[
\text{Expr} \rightarrow \text{Expr} + \text{Expr}
\]

\[
\text{Expr} \rightarrow \text{Expr} \ast \text{Expr}
\]

\[
\text{Expr} \rightarrow \text{id}
\]

1. [10 points] Is $G$ SLR(1)? Justify.
3. [10 points] Is $G$ SLR(0)? Compute the collection of LR(0) sets of items for $G$.
4. [10 points] Construct the SLR(1) action table for $G$.
5. [10 points] Is $G$ SLR(1)? If not, how can you modify $G$ to get a grammar $G'$ such that $G$ and $G'$ represent the same languages, where $G'$ is SLR(1)?

END OF EXAM