

National Institute of Technology, Rourkela
Mid Semester Examination, Autumn 2021
Compiler Design (CS 3007)
5th semester B.Tech in Computer Science & Engineering

Duration: 2 Hours
Number of pages: 1

Full Marks: 30

- Attempt all questions.
- If you answer a question, all sub questions should form part of it.
- For each grammar the capital letters represent non-terminals while lower case letters and digits represent terminals. S is the starting symbol and terminal $\$$ is the end-of-string symbol.

Q 1. Consider a set of words having a, e, i, o , and u appearing in that order, although not necessarily consecutively.

- (a) Write its regular expression. [1]
- (b) Construct its non-deterministic and deterministic finite automata. [2+2]

Q 2. Consider a grammar G with rules $S \rightarrow aAc, A \rightarrow Ab|\epsilon$

- (a) Is G left recursive? Justify it. [1]
- (b) Write left recursion free equivalent of G . [4]

Q 3. (a) Define an $LL(k)$ grammar. [1]

- (b) Find the value of k for an $LL(k)$ grammar G with rules $S \rightarrow aSb|\epsilon$. Justify it. [1]
- (c) Construct the $LL(k)$ parsing table for G . [1]
- (d) Give a trace of deriving the input strings - " $aabb\$$ " and " $abb\$$ ". [1+1]

Q 4. Given a grammar G having rules $S \rightarrow E\$, E \rightarrow T, E \rightarrow E + T, E \rightarrow E - T, T \rightarrow id, T \rightarrow (E)$

- (a) Is G $LR(0)$ or $LR(1)$, or both? Formally justify your claim. [3]
- (b) Give a trace for deriving the input strings - " $id + id\$$ " and " $id\$$ ". [1+1]

Q 5. Is the grammar $S \rightarrow 1S0|0S1|10$ an $SLR(1)$ grammar? Give a formal justification in support of your claim. [5]

Q 6. Is the grammar $S \rightarrow aAd|bBd|aBe|bAe, A \rightarrow c, B \rightarrow c$ $CLR(1)$ or $LALR(1)$, or both? Explain with justification. [5]

*****All the best*****