COL226: Programming Languages

Mon 14 Feb 2022 **MinorQ2** 5+15 (+5 for PwD) minutes Max marks 10

Instructions:

1. Download the paper and write your name and entry number in the designated space on top and *do not forget to sign the honour statement below.*
2. Answer the question(s). *Answers will be judged for correctness, efficiency and elegance.*
4. If there are minor mistakes in the question, correct them explicitly and answer the question accordingly. If the question is totally wrong, give adequate reasons why it is wrong with detailed counter-examples, if necessary.
4. Scan the paper with your completed answer.
5. Upload it on Gradescope 2102-COL226 page within the given time. *Make sure the first page with your name, entry no and signature is also the first page of your uploaded file*
6. Late submissions (within 2 minutes of submission deadline) on the portal will attract a penalty of 10% of the total marks allotted to the paper for each minute of delay and 20% for each minute of delay thereafter.
7. Email submissions after the closing of the portal will not be evaluated (You get a 0).
8. Uploads without the first page details (including signature) may be awarded 0 marks.

I abide by the Honour code that I have signed on my admission to IIT Delhi. I have neither given any help to anybody nor received any help from anybody nor from any site or other sources in solving the question(s) in this paper.

Signature: **Date:**

[4+6=10 marks]

In most programming languages the values of real constants (such as the unsigned binary real numbers of the previous question) are computed during the scanning phase. But Shilly-shally Shelley and Dilly-dally Dolly had other ideas. Instead of using regular expressions, they used grammars and syntax-directed translation to compute the values during the semantic analysis.

1. Shilly-shally Shelley designed the following grammar $G_S = \langle N, T, P, S\rangle$ where $N = \{S, I, F, B\}$, $T = \{\texttt{0}, \texttt{1}, .\}$ with the following productions P.

$$\begin{array}{lcl} S & \rightarrow & .F \mid I. \mid I.F \\ I & \rightarrow & B \mid IB \\ F & \rightarrow & B \mid BF \\ B & \rightarrow & \texttt{0} \mid \texttt{1} \end{array}$$

   and defined a purely synthesized attribute *val* to yield the value of the real number in $S.val$. What attribute grammar rules did Shilly-shally Shelley use to get the correct values?

2. When Dilly-dally Dolly woke up and asked Shilly-shally Shelley for the grammar, she got the following productions instead.

$$\begin{array}{lcl} S & \rightarrow & .F \mid I. \mid I.F \\ I & \rightarrow & B \mid BI \\ F & \rightarrow & B \mid FB \\ B & \rightarrow & \texttt{0} \mid \texttt{1} \end{array}$$

   What attribute grammar rules should Dilly-dally Dolly define to get the correct values in $S.val$?