

1. (a) Textbooks typically describe a compiler as composed of distinct phases linked by unidirectional arrows. Discuss reasons why real compilers are not usually structured in this way. [7]
- (b) Explain clearly the difference between pushdown automata and *deterministic* pushdown automata and the relevance of this distinction to parser construction. [7]
- (c) Consider the grammar below:

$$S \rightarrow a S b \mid A B A \mid b$$
$$C \rightarrow A A c \mid d$$
$$A \rightarrow a b B A \mid a \mid \text{eps}$$
$$B \rightarrow A b A \mid b \mid C A$$

where S is the start symbol and eps is the empty string. Calculate the First and Follow sets and the Nullable predicate for each of the nonterminals. [11]