Compiler Construction

(a) Consider the grammar

\[
S ::= (L) | a \\
L ::= L, S | S
\]

(i) Present a right-most derivation for the string \((a, ((a, \ a), \ (a, \ a)))\).

\[3 \text{ marks}\]

(ii) Present a left-most derivation for the same string \((a, ((a, \ a), \ (a, \ a)))\).

\[3 \text{ marks}\]

(b) Automatic garbage collection is an important technique for the implementation of many programming languages. Define each of the following variations:

(i) Mark and Sweep; \[3 \text{ marks}\]

(ii) Copy Collection; \[3 \text{ marks}\]

(iii) Generational Collection. \[3 \text{ marks}\]

(c) Write a small program that will produce different values depending on which kind of variable scoping mechanism is used, static or dynamic. Explain your answer. \[5 \text{ marks}\]