Q1. a) Design a PDA that accepts the language $\{a^n b^m \mid 1 < n < m\}$ by Final State

   b) Design a PDA that accepts the language $\{a^n b^m \mid n > m > 1\}$ by Empty Stack

   For both the problems explain your algorithm clearly before describing the PDA.

$$[4 + 3 = 7]$$

Q2. a) Write the grammar to accept Arithmetic expressions given as below:

   · An identifier is an Arithmetic expression - where an identifier is of maximum
      2 characters from $\sum = \{a, b\}$
   - Given an arithmetic expression E, (E) is an arithmetic expression
   · Given two arithmetic expressions A and B, A + B and A - B are arithmetic expressions.

   b) Express the above grammar in CNF.

$$[2 + 5 = 7]$$

Q3. a) Explain the CYK algorithm. What is its complexity? Justify your answer.

   b) Consider the grammar G with the following production rules:

   S → AB
   A → a
   B → b| CD
   C → AB
   D → c

   Use CYK algorithm to check whether the string "aaabccc" belongs to L (G).

$$[3 + 4 = 7]$$

AB
← CD
a ABc
aa Ccc
a ABcc
coabcc

AB
AABcc

S→ aB