Q1. Find regular expression (RE) that defines the language of all words with at least one a and one b, and build finite automata (FA) that accepts the same language. (10 Marks)

Q2. Build a Turing machine (TM) that accepts the language: \{a^n c^n b^n : n \geq 0\} (10 Marks)

Q3. Build a Mealy machine that can count how many times the substring abba occurs in a long input string, then convert it to Moore machine. (10 Marks)

Q4. Convert the following CFG into CNF:
   \[S \rightarrow aAb \mid bAa\]
   \[A \rightarrow AaB \mid bAaA \mid \Lambda\] (10 Marks)

Q5. Build pushdown automata (PDA) for the language: \{sa^n b^m : s is any string of \{a,b\}, n \geq 1, m \geq 0 and length(s)=n \}. (10 Marks)

Q6. Find CFG that accepts the language of all words with equal number of a's and b's, such as ababbaab. Can you find FA that accepts the same language, And why? (10 Marks)

Q7. If you have FA1 that accepts all words with even number of a's, and FA2 that accepts all words ending with b, build FA3 that accepts all words that have even number of a's or that end with b by using Kleen's theorem. (10 Marks)

Q8. If your input alphabet is \{a,b\}, build finite automata (FA) that accepts all words except aba and a, then find regular grammar (RG) that accepts the same language. (10 Marks)