Q1. If $\Sigma = \{a,b\}$, $RE1 = (a+b)((a+b)(a+b))^*$ and $RE2 = a^+$, find FA that accepts the language defined by: $RE = RE1 + RE2$ by using Kleen's theorem. (10 Marks)

Q2. Build a Turing machine (TM) that accepts the language: $\{a^{2n}b^n a^{2n} : n \geq 0\}$ (10 Marks)

Q3. Build a Mealy machine that can increment the input by one, such as if your input is 1011 then the output will be 1100, then convert it to Moore machine. (10 Marks)

Q4. Convert the following CFG into CNF:

$S \rightarrow XaX$
$X \rightarrow ZY$
$Z \rightarrow abZ | baZ | ab | ba | Y$
$Y \rightarrow aa | bb | \Lambda$ (10 Marks)

Q5. Build a pushdown automata (PDA) for the following language:

$\{a^n b^{n+2} : n \geq 0\}$ (10 Marks)

Q6. Find CFG for each of the following languages:

$L1 = \{a^{2n}b^m a^{2n} : n \geq 0, m \geq 2\}$.
$L2 = \{a^n b^m c^k : n \geq 0, m \geq 1, k=0,2,4,6,...\}$ (10 Marks)

Q7. Find FA and RE that accepts the same language accepted by the following CFG:

$S \rightarrow aA | bB$
$A \rightarrow aA | bB | \Lambda$
$B \rightarrow aB | bZ$
$Z \rightarrow aZ | bA$ (10 Marks)

Q8. Build transition graph (TG) that accepts all words that have different first and last letter, then find the RE and CFG for the same language. (10 Marks)