1. Design a PDA to accept the strings in \((0+1)^*\) such that no prefix has more 1’s than 0’s.  
   01001011001 is a string in this language. Say whether your PDA accepts by final state or empty stack.

2. Design a PDA to accept \(\{a^i b^j c^k \mid i=j \text{ or } j=k\}\). Say whether this accepts by final state or empty stack.

3. Design a PDA to accept \(\{0^i 1^n \mid n \leq m \leq 2n\}\)

4. Convert the following grammar into a PDA that accepts by empty stack.
   \[
   S \Rightarrow 0S1 \mid A \\
   A \Rightarrow 1A0 \mid S \mid \varepsilon
   \]

5. Here is a PDA that accepts strings in \((0+1)^*\) with the same number of 0’s and 1’s. This PDA accepts by empty stack. Chomsky’s algorithm gives a grammar equivalent to this PDA, with grammar symbols of the form \([pXq]\). Give a derivation in this grammar for the string 0101.

```
1,1|11
1,0|\varepsilon
1,Z_0|1Z_0
0,0|00
0,1|\varepsilon
0,Z_0|0Z_0
```

```
P  \varepsilon,Z_0|\varepsilon \quad \rightarrow \\
   \downarrow \hspace{1cm}
   \quad Q
```