1. 2.30 (part a and d.)

2. Show that the following language is not context-free.

\[
\{a^i b^j c^k \mid 1 \leq i^2 < j^2 < k^2 \}
\]

3. Formulate a formal definition of a 2-stack Pushdown automaton. The intuitive idea is that you should augment the definition of an ordinary 1-stack Pushdown automaton, except now you have two stacks. (You should state what it is, what a sequence of operations constitutes a valid sequence of moves on an input, and what constitutes acceptance.)

4. Give an informal description of how to simulate any one-tape Turing machine by a 2-stack Pushdown automaton.

5. Use the equivalence of CFL and PDA to prove the following: If \( L \) is a CFL, and \( L' \) is a regular language, then \( L \cap L' \) is also a CFL.

6. 2.16.

7. 3.2 part b, d. page 187.

8. 3.4. You need to specify in terms of a set of tuples, and transition function \( \delta \), etc.

9. 3.6.

10. Design a Turing machine to accept the following language

\[
L = \{0^n1^n2^n \mid n \geq 1 \}.
\]

(You can describe your Turing machine as a diagram as in Fig 3.8 or 3.10.)

11. Design a Turing machine to perform the following task:

Upon input of any string over \( \{0, 1\} \) of length \( n \) (on the input tape, all other symbols initially are the blank symbol), it computes \( n^2 \), by eventually leaving \( n^2 \) non-blank symbols on the TM tape and then it halts.

Note: You should get on to your homework as soon as possible. Don’t delay to the last minute.