0: Briefly explain the system used in the Sipser textbook to number the sections, subsections, exercises, problems, figures, examples, theorems, etc..

1: Let G and H be two undirected graphs, which are disjoint from each other. Assume each of G and H is connected, acyclic, and non-empty (at least one node). Prove the following two statements:
   a. Adding one edge between a node in G and a node in H results in a single connected, acyclic graph.
   b. Adding two distinct edges between G and H, as in 3.a, results in a single connected, cyclic graph.

Inspired by Sipser Exercises: pp 25-27:

2: Let $\Sigma = \{a, b, c, 0, 1\}$. Let X be the set $\{x, y, z\}$ and let B be the set $\{0, 1\}$. Answer the following questions.
   a. List the elements of $B \times (B \times X)$
   b. List the elements of $(B \times B) \times X$
   c. List the elements of the power set $\mathcal{P}(X)$
   d. List the elements of the language concatenation: $B \cdot X$
   e. What is the language concatenation $B^* \cdot \{}$ ?
   f. What is the Cartesian Product $\{} \times X^*$ ?
   g. What is the Cartesian Product $\{ \varepsilon, 1 \} \times X$ ?

Inspired by Sipser Exercises: p 84:

3: Let alphabet $\Sigma = \{a, b\}$. Show a DFA which recognizes the following language over $\Sigma$. Show the DFA as a fully specified state diagram. Be sure to clearly indicate your initial state and Accepting state(s).

$$L_3 = \{w \in \Sigma^* \mid \text{the number of a's in } w \text{ is evenly divisible by 7} \}$$

Briefly describe how your design works.
4: Let alphabet $\Sigma = \{0, 1\}$. Show a DFA which recognizes the following language over $\Sigma$. Show the DFA using the formal 5-tuple notation. Make sure you clearly define all five components of the DFA, and ensure that your transition function $\delta$ is fully specified. You may define $\delta$ using a function table or using more succinct mathematical notation.

$L_4 = \{w \in \Sigma^* \mid \text{w has even parity, and no run of 0's is longer than 3}\}$

Briefly describe how your design works.

5: Let alphabet $\Sigma = \{c, d, e\}$. Show an NFA which recognizes the following language over $\Sigma$. Specify the NFA as a fully specified state diagram. Be sure to clearly indicate your initial state and Accepting state(s).

$L_5 = \{w \in \Sigma^+ \mid \text{w contains substring ccc or ddd}\}$

Briefly describe how your design works.

6: Briefly describe in English the language over $\Sigma = \{0, 1, 2\}$ accepted by this DFA:

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