Section 1.2 [Sip] NFA's:

- NFA example (with $\delta(q, a) = \emptyset$)

- Thm: $L$ recognized by an NFA $\Rightarrow$ some DFA.

- Corollary: Regular languages closed under $\cap, \cup, \text{complement}, \epsilon, \ast$

Section 1.3 [Sip] Regular Expressions:

- Def of Regular Expression: any $\cup, \epsilon, \ast$
  of $\{\text{single letter}\}, \{\epsilon\}, \emptyset$

- Thm: $L$ described by a regular expression $\Leftrightarrow$ $L$ is regular.
Breakout Room Questions:

1) How many states needed to recognize $\{a^5, a^7\}^*$ by a DFA

2) How many states needed to recognize $\{a^5, a^7\}^*$ by an NFA

3) If an NFA has 1000 states, its corresponding DFA may have roughly $2^{1000}$ states. Is there a relatively quick way to see if the NFA accepts a given string?
(4) Give an NFA that recognizes

\[ L = \{ w \in \{0,1\}^* \mid \text{the 3rd to last symbol of } w \text{ is } 1 \} \]

\[ = \{ 0,1 \}^* \circ \{ 1 \} \circ \{ 0,1 \}^2 \]

\[ = \left\{ \sigma_1 \ldots \sigma_k \mid k \geq 3, \sigma_1, \ldots, \sigma_k \in \{ 0,1 \} \right\} \]
with \( \sigma_{k-2} = 1 \)

(5) Give a DFA that recognizes

\[ L \text{ in question (4)} \]