Section A, quiz 1 solutions

1. Write a regular expression over $\Sigma = \{0,1\}$ that generates the following language
$L = \{w | w \text{ is any string except } 11\}$

$$\emptyset \cup 1 \cup \Sigma^* 0 \Sigma^* \cup 111 \Sigma^*$$

2. Give the state diagram of an NFA that recognizes language $M$ described by regular expression $(0 \cup 1)^* 0 (0 \cup 1)^*$

![NFA State Diagram](image)

3. $L$ is the language of question 1, $M$ is the language from question 2. Is the following statement true?

The concatenation $L.M$ is a regular language: TRUE

4. Give the state diagram of a DFA recognizing the following language over alphabet $\{0,1\}$: $\{w | w \text{ has length at least 3 and its } 3^{\text{rd}} \text{ symbol is a } 1\}$

![DFA State Diagram](image)

5. Show that $A$ is not regular.
$A = \{0^i 1^j | i < j\}$

If $A$ is regular, the pumping lemma holds.
Let $p$ be the pumping length.
Let $s = 0^p 1^{p+1}$
$s = xyz$, $|xy| \leq p$, $|y| > 0$
So $y = 0^k$, $k \leq p$
For $i = 2$, $xy^iz = xyyz$ not in $A$, since it has $\#0$'s $\geq \#1$'s