This is a 50-minute in class closed book exam. All questions are straightforward and you should have no trouble doing them. Please show all work and write legibly. Thank you.

1. Write a regular expression denoting all strings in which every third symbol is a 0. Some strings in the set are $\varepsilon$, 010, 1101101, 0001101001, etc.

2. Express the set
   $$\big\{0^n10^{n-1}10^{n-2}\ldots1000100101\big| n \geq 1\big\}$$
   in terms of intersection, $\cup$, $\bullet$, and $*$ and the set $\big\{0^{i+1}10^i\big| i \geq 1\big\}$.

3. Use the pumping lemma to prove that $L = \{a^ib^j \big| i \leq j\}$ is not regular.

4. Use homomorphism, inverse homomorphisms and intersection with regular sets to express the set obtained from an arbitrary set $L$ by deleting in each string every 1 appearing in an even numbered position and preceded by a 0.