Fill in the answers.

1. (2.5 points: 0.5 point for each) Given the alphabet \( \Sigma = \{ 11, 2, 33 \} \).
   Can we say that 1112222333 is a string over \( \Sigma \)? (yes/no) ____ NO
   Can we say that 112233 is a string over \( \Sigma \)? (yes/no) ____ YES
   Can we say that \( \lambda \) is a string over \( \Sigma \)? (yes/no) ____ YES
   Can we say that \( \{ \lambda \} \) is a language over \( \Sigma \)? (yes/no) ____ YES
   Can we say that \( \emptyset \) is a language? (yes/no) ____ YES

2. (1.5 points: 0.5 point for each) Given strings \( u \) and \( v \) over the alphabet \( \Sigma \).
   Can we say that \((uv)^R = u^Rv^R \) ? (yes/no) ____ NO
   Can we say that \( uv = vu \) ? (yes/no) ____ NO
   Can we say that for any \( i > 0 \) natural number \((uv)^i = u^iv^i \) ? (yes/no) ____ NO

3. (1 point) Given the recursive definition of a language \( L \) over the alphabet \( \{a, b\} \)
   Basis: \( b \in L \)
   Recursive step: if \( u \in L \) then \( au \in L \) and \( bu \in L \).
   Closure: a string is in \( L \) if it can be obtained from the basic element by finite number of applications of the recursive step.
   Check all the strings that are strings of \( L \) (one wrong answer will cost you the point)
   ____aaa, _X_abbb, ___X_ababab, ____abababa, ______bbbaaa, ___X_aababb, _____\lambda

4. (1 point) Given the following regular expressions over the alphabet \( \{a, b\} \)
   1) \((a \cup b)^* \)
   2) \((a^*b^*)^* \)
   3) \((a^*b^* \cup b^*a^*)^* \)
   Which regular expressions are equivalent? Check the correct answer.
   ____ 1) and 2) are equivalent, but they are not equivalent to 3).
   ____ 1) and 3) are equivalent, but they are not equivalent to 2).
   ____ 2) and 3) are equivalent, but they are not equivalent to 1).
   ____ there are no equivalent regular expressions among those listed.
   ___X___ all listed regular expressions are equivalent to each other.

5. (1 point) Given a language over the alphabet \( \{a, b, c\} \) defined with the help of a regular expression
   \( a^*b^* \cup c^+ \)
   Check all the strings that are strings of \( L \) (one wrong answer will cost you the point)
   ____X_aaa, ___aaabbbccc, ___ababab, ____bababa, ______bbbaaa, ___X_aaabbb, _____\lambda

6. (1 point) Given set \( X = \{a, b, c\} \).
   How many elements has the set \( X^5 \), (give a number) __3^5__
7. (1 point) Fill in the answer: $\emptyset^* = _{\{\lambda\}}_\_\_\

8. (1 point) Given $X$ and $X^*$ sets.
   How can $X^*$ be obtained with the help of these two sets?
   Give the formula: $X^* = _{XX^*}\_

9. (1 point) Given the alphabet $\Sigma=\{a,b,c\}$. Is $\Sigma^*$ countable (yes/no)? _YES_

10. (1 point) Given the alphabet $\Sigma=\{a,b,c\}$.
    Is the set of all possible languages over $\Sigma$ countable (yes/no)? _NO_

11. (1 point) Given languages $X = \{aaa, bbb, ccc\}$, $Y = \{a, b, c, aaa\}$ over the alphabet $\Sigma = \{a,b,c\}$.
    Is the language $L = X \cap Y$ a regular set over $\Sigma$? (yes/no) _YES_

12. (1 point) Given alphabet $\Sigma = \{a,b\}$. Is $(a \cup b)^* bb (a \cup b)^* \cap a (a \cup b)^* a$ a regular
    expression over the alphabet $\Sigma$? (yes/no) _NO_

13. (1 point) List the basic regular sets over the given alphabet $\Sigma$ (the sets mentioned in
    the basis of the recursive definition of a regular set over alphabet $\Sigma$).
    _$\emptyset$, $\{\lambda\}$, $\{a\}$ for every $a \in \Sigma$_ _________________________________

14. (1 point) List the set operations that are used in the recursive step of the recursive
    definition of a regular set over the alphabet $\Sigma$ (the set operations that are used to build
    new regular sets from the known ones).
    _Union, Concatenation, Kleene Star_ _________________________________