**CSE 351**

**Programming Languages**

**Homework Assignment #2**

**Due Date: 3rd of April 2020 @17:00**

Consider the following grammar for the following questions.

**Rule**

**1. F 🡪 T a ( A )**

**2. T 🡪 a S**

**3. | ε**

**4. S 🡪 \* S**

**5. | ε**

**6. A 🡪 L**

**7. | ε**

**8. L 🡪 T a M**

**9. M 🡪 b L**

**10. | ε**

1. Show the leftmost derivation for the following input strings and state if the input is accepted or rejected. Please also indicate the rule number that you apply at each step of the derivation.

a) a \* \* a ( a a )

<F> => Ta(A)

=>aSa(A)

=>a\*Sa(A)

=>a\*\*a(A)

=>a\*\*a(L)

=>a\*\*a(TaM)

=>a\*\*a(aSaM)

=a\*\*a(aa)

b) a \* a ( b )

<F> =>Ta(A)

=>aSa(A)

=>a\*a(A)

=>a\*a(L)

=>a\*a(TaM) => ERROR a a\*a(aM) -> Not in the language

c) a \* \* a ( a b a \* a b a )

<F> =>Ta(A)

=>aSa(A)

=>a\*\*a(L)

=>a\*\*a(TaM)

=>a\*\*a(aSaM)

=>a\*\*a(aM)

=>a\*\*a(abL)

=>a\*\*a(abTaM)

=>a\*\*a(aba\*aM)

=>a\*\*a(aba\*abL)

=>a\*\*a(aba\*aba)

2. Show the parse tree for the input a \* \* a ( a b a \* a b a )

**1. F 🡪 T a ( A )**

**2. T 🡪 a S**

**3. | ε**

**4. S 🡪 \* S**

**5. | ε**

**6. A 🡪 L**

**7. | ε**

**8. L 🡪 T a M**

**9. M 🡪 b L**

**10. | ε**

<F> =>Ta(A)

=>aSa(A)

=>a\*\*a(A)

=>a\*\*a(L)

=>a\*\*a(TaM)

=>a\*\*a(aM)

=>a\*\*a(abL)

=>a\*\*a(abTaM)

=>a\*\*a(aba\*aM)

=>a\*\*a(aba\*abL)

=>a\*\*a(aba\*aba) =>Correct

3. Write the corresponding EBNF grammar for the BNF given below. Try to use [ ], ( | ) and { } operators as many as you can.

|  |  |
| --- | --- |
| **F 🡪 T a ( A )**  **| T a**  **T 🡪 a S**  **| ε**  **S 🡪 \* S**  **| ε**  **A 🡪 L**  **| ε**  **L 🡪 T a M**  **| T b M**  **M 🡪 b L**  **. | ε** | <F> -> <T> a [( <A> )]  <T> -> (a<S>) | ε  <S> -> {\*} | ε  <A> -> <L> | ε  <L> -> <T>(a|b)<M>  <M> -> b<L> | ε |
|  |  |

4. Write a BNF grammar that accepts all the strings with at least three “012” patterns. For instance, strings “012012012” and “01222221201221212101212” are accepted, but “012”, “222”, “01220202020201200000011112” are rejected. Assume that the alphabet is {0,1,2,3} for the problem.

<pat> = 012

<number> => 0|1|2|3

<numbers> => <number> | <number><numbers>| ε

<pattern> => <numbers><pat><numbers><pat><numbers><pat><numbers>

|

5. Draw an NFA for recognizing strings of problem 4, and then write its corresponding regular grammar.

