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CS 360 - 002
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Quiz 2

1. Regular Expression: $(0+2+10+12)*(1+epsilon)$
   Explanation:

   $(0+2+10+12)*$

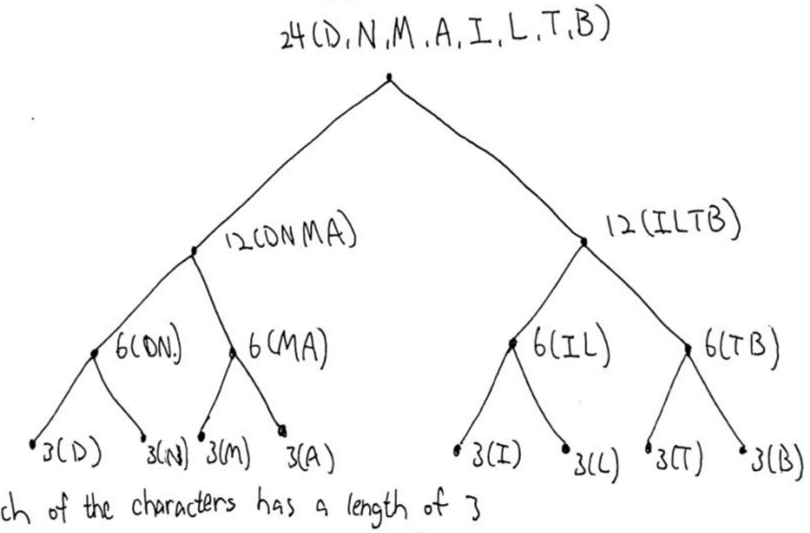
   There will be any number of 0's and 2's, but if there is a 1 then it should be followed by a 0 or 2.

   $(1+\varepsilon)*$

   If a String is ending with 1, it is possible to liaise previously 10 or 12 or 0 or 2 cost. If a string is not ending with 1, then it will be epsilon.

2. The maximal of a Huffman Tree refers to the maximum number of branches that a tree may have that make up the depth. The minimal of a Huffman Tree refers to the minimum number of branches that a tree may have that make up the tree's depth. The average code length is represented as the sum of the leaves' frequency divided by the number of leaves within the Huffman Tree. All code lengths can be equal if each character is used equally as often. Although rare, it is possible for characters to be used equally as commonly. The lengths cannot be equal to 1, 2, 3, …,n-2, n-1, n-1. Drawing such a tree will result in a parent node with only one child.

   Example:



Each of the characters has a length of 3
D-000 N-001 M-010 A-011
I-100 L-101 T-110 B-111

3.

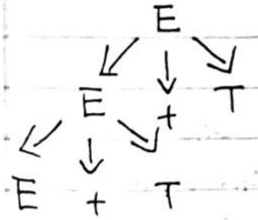
#3 $G: E \rightarrow E+E \mid E*E \mid (E) \mid id$

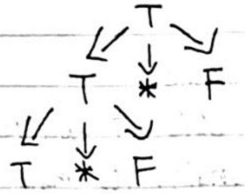
(i) $E \rightarrow E + T \mid T$ $((T_1+T_2)+ \ldots + T_k)$

$T \rightarrow T * F \mid F$ $((F_1+F_2)* \ldots * F_k)$

$F \rightarrow id \mid (E)$

$id \rightarrow |1|2|3| \ldots |8|9|$





Both + and * are left associative

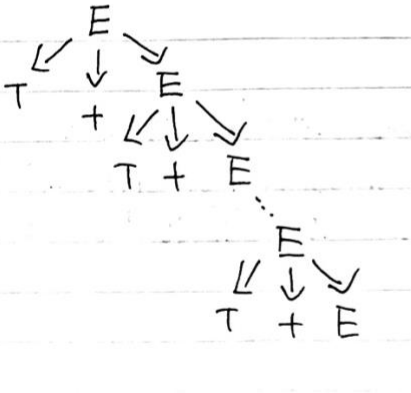
(ii) Both + and * are right associative

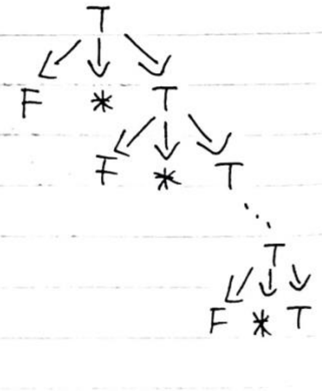
$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$ $((T_1+T_2)+ \ldots + T_k)$

$F \rightarrow id \mid (E)$ $((F_1+F_2)* \ldots * F_k)$

$id \rightarrow |1|2|3| \ldots |8|9|$





(iii) operation + is left associative and operation * is right associative

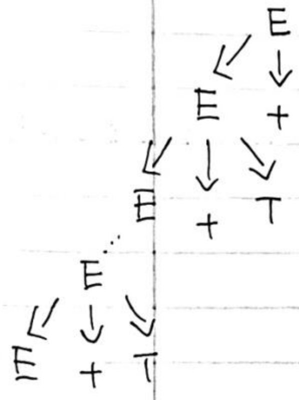
$E \to E + T \mid T$

$T \to T * F \mid F$ $\qquad ((T_1 + T_2) + \dots + T_\varepsilon)$

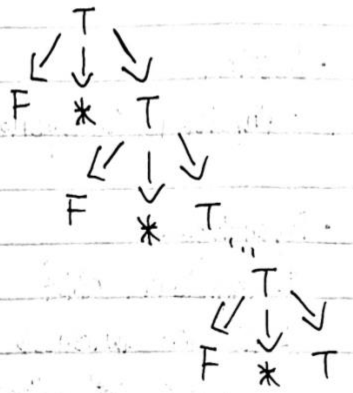
$F \to id \mid (E)$ $\qquad ((F_1 + F_2) * \dots * F_\varepsilon)$

$id \to | 1 | 2 | 3 | \dots | 8 | 9 |$

Operation +



operation *



(iv) Operation + is right associative and operation * is left associative

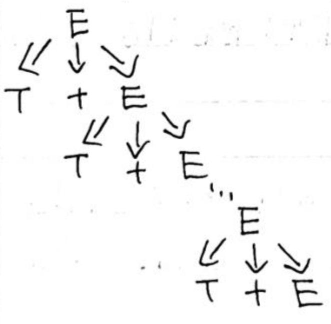
$E \to E + T \mid T$

$T \to T * F \mid F$ $\qquad ((T_1 + T_2) + \dots + T_\varepsilon)$

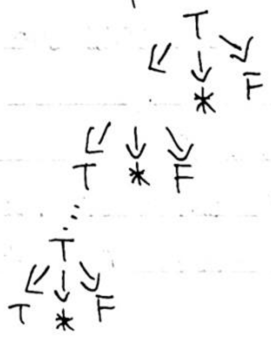
$F \to id \mid (E)$ $\qquad ((F_1 + F_2) * \dots * F_\varepsilon)$

$id \to | 1 | 2 | 3 | \dots | 8 | 9 |$

Operation +



Operation *



4. A grammar will be unambiguous if it does not contain more than one leftmost derivation or more than one rightmost derivation

   Rule:

   1. If the left associate operator (+, -, *, /) are used in the production rule then apply left recursion in the production rule

      $$x \to ax$$

   2. If the right recursive operator (^) is used in the production rule then apply right recursion in the production rule

      $$x \to xa$$

   Example 1:

   Consider the ambiguous grammar – because there will be two part for (a & b)

   $S \to AB|aaB$

   $A \to a|Aa$

   $B \to b$

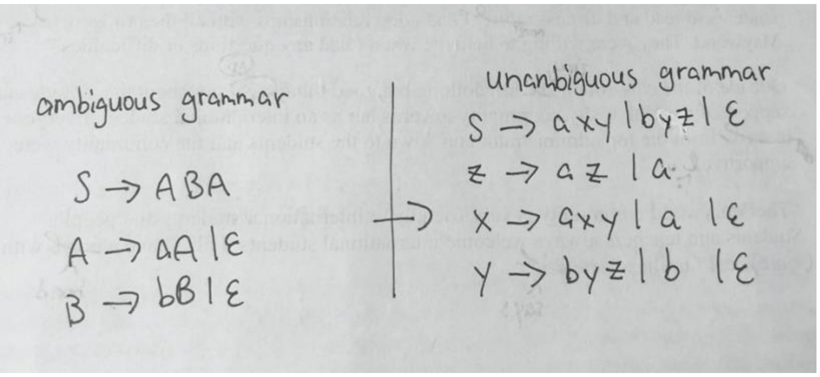
   Now, the unambiguous grammar will be

   $S \to AB$

   $A \to Aa|a$

   $B \to b$

   Examples 2:



ambiguous grammar

$S \to ABA$

$A \to aA|\varepsilon$

$B \to bB|\varepsilon$

$\to$

unambiguous grammar

$S \to axy|byz|\varepsilon$

$z \to az|a$

$x \to axy|a|\varepsilon$

$y \to byz|b|\varepsilon$

Report:

Practice Problems:

2.4 – 3

2.5 - 2