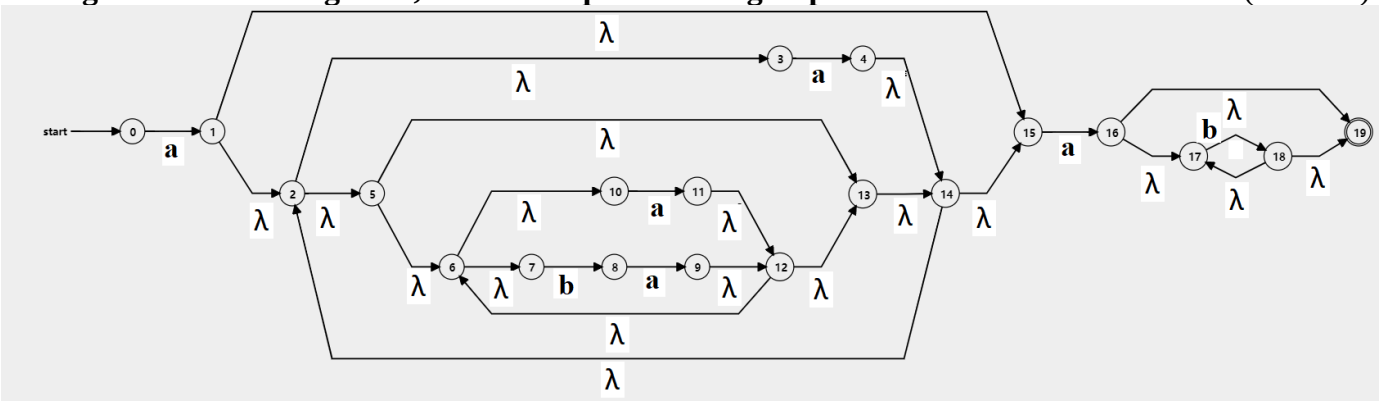
Question (1) [20 Marks]

a- The roles of Lexical analyzer are 1- ---------- 2- ---------- 3- ---------- (3 Marks)

b- **Discuss the concept of Grammar , Context-Free Grammar. (4 Marks)**

c- **given the following NFA, write the equivalent Reg. expression** (5 Marks)



d- Refer to problem 1-c , construct the equivalent DFA, show your work step-by step (8 Marks)

Question (2) [15 Marks]

a- Give the regular expressions that represent the following strings over the alphabet {a,b,c} (6 Marks)

1) **All strings containing odd number of c's.**
2) **All strings that have at least one c and at least one b.**

b - A grammar with N = {S, A, B}, T = {a, b} and P are as follows: (9 Marks)

1- S→ aAB
2- A→bBb
3- B→A
4- B→ λ

Show **leftmost derivation and rightmost derivation** of the string $a\,b^4$. Then choose **the correct answer** in the following :

(1) Number of applications of Rule number 2 is
A - ONE B- TWO C- Three D- FOUR

(2) Number of applications of Rule number 3 is only once (A: TRUE / B: FALSE)

(3) Number of applications of rule number 4 is 3 times (A: TRUE / B: FALSE)

Question 3 [15 Marks]

a- Show the FIRST and FOLLOW sets using the following Grammar: (5 Marks)

E → TR
R → +TR | λ
T → FY
Y → *FY | λ

F ➔ (E) | id

b- Given the following SLR table and Grammar G **(10 Marks)**

(1) $E \to E+T$
(2) $E \to T$
(3) $T \to T*F$
(4) $T \to F$
(5) $F \to (E)$
(6) $F \to \text{id}$

STATE	ACTION						GOTO		
	id	+	*	(	)	$	E	T	F
0	s5			s4			1	2	3
1		s6				acc			
2		r2	s7		r2	r2			
3		r4	r4		r4	r4			
4	s5			s4			8	2	3
5		r6	r6		r6	r6			
6	s5			s4				9	3
7	s5			s4					10
8		s6			s11				
9		r1	s7		r1	r1			
10		r3	r3		r3	r3			
11		r5	r5		r5	r5			

Parsing table for expression grammar

Use them to parse the input (id1+id2) * id3

Question 4 [20 Marks]

a- Use the following table and Grammar to perform the Non-recursive predictive parsing for id* (id+id) **(8 Marks)**

NON-TERMINAL	INPUT SYMBOL					
	id	+	*	(	)	$
E	$E \to TE'$			$E \to TE'$		
E'		$E' \to +TE'$			$E' \to \epsilon$	$E' \to \epsilon$
T	$T \to FT'$			$T \to FT'$		
T'		$T' \to \epsilon$	$T' \to *FT'$		$T' \to \epsilon$	$T' \to \epsilon$
F	$F \to \text{id}$			$F \to (E)$		

$E \to T\,E'$
$E' \to +\,T\,E' \mid \epsilon$
$T \to F\,T'$
$T' \to *\,F\,T' \mid \epsilon$
$F \to (\,E\,) \mid \text{id}$

b- Given the grammar

$E \to E + T \mid T$
$T \to T * F \mid F$
$F \to (\,E\,) \mid \text{id}$

Use shift-reduce method to parse the string (id+id) **(7 Marks)**

c- Define the Term SDD, illustrate using simple example. **(5 Marks)**

Good Luck ☺