EDO UNIVERSITY, IYAMHO, EDO STATE
FACULTY OF SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
First Semester Examination, 2017/18 Session

Course Title: Automata Theory and Formal Languages **Course Code:** CMP 314
Time allowed: 2hrs **Instruction:** Answer Five (5) Questions Only **Date:** 26/04/2018

Q1. Language L over alphabet {a, b, c} is defined by means of the following three conditions:

i. phrases start with letter a
ii. phrases end with letter c
iii. phrases may not contain any of the following four two-letter factors: b a b b c a c c

a. Write a regular expression of language L by using only union, concatenation and star operators.
b. Define language L, the complement of language L, by modifying suitably the three conditions (i, ii, iii) above. **14mks**

Q2. Write brief notes on the following parser generators

a. Lex
b. Yacc
c. Irony **14mks**

Q3. Consider the strings over alphabet § = {a, b, c} and the two following constraints: if the string contains two or more letters a, they are not adjacent, and if the string contains one or more letters b, at least one of them is followed by at least one letter c, at whatever distance. Write the two regular expressions (no matter if ambiguous) that generate the strings corresponding to the former and latter constraint, respectively (that is one expression for each constraint. **14mks**

Q4. With annotated examples; discuss in full, the difference between BNF and EBNF **14mks**

Q5. Consider the following regular expression R over alphabet {r, k, m}: R = (r | ") (k | m)¤ (k m | r k)¤

a. List all the strings of length ≤2 generated by expression R and say which ambiguity degree they have (that is in how many different ways each string is generated by R).
b. Design the Non-deterministic automaton A of expression R.
c. Design the Deterministic automaton A of expression R, obtained from the previous one by means of the subset construction. **14mks**

Q6. Given L1 = a((b | bb)a)+ (ab)¤ba, and L2 = (a(ab)¤b)¤(" | a(ab)¤ | ab) (a(ab)¤b)¤

a. Write the three shortest strings of L1 \ L2
b. Deduce a language for L1 \ L2 and L1 −L2 **14mks**

Q7. Consider the following grammar G, in extended form (EBNF), over terminal alphabet {a, b, c, d} and with axiom S: G >>>>><
S ! A a
A ! (a A¤ A | B) b
B ! a C | c
C ! d C | d>>>>>>:

a. Represent grammar G as a network of recursive finite state automata.
b. Check each of the four non-terminals S, A, B and C separately, and find the smallest integer k ≥ 1 such that the considered non-terminal is of type LL(k). **14mks**