UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, APRIL/MAY 2019

COURSE NO: CE 470
COURSE NAME: COMPILER DESIGN
CLASS: CE IV **TIME:** 3 HRS

Name**:** _____Index Number: _____

This paper has two sections: A and B. Each correct answer in section A carries 1 mark. Answer all questions in section A. In section B, choose one question in each part. Answer all questions in the answer booklet.

SECTION A

1. The lexical analysis for a modern computer language such as Java needs the power of which one of the following machine models in a necessary and sufficient sense?

   a. Finite state automata
   b. Deterministic pushdown automata
   c. Non-Deterministic pushdown automata
   d. Turing Machine

2. Match all items in Group 1 with correct options from those given in Group 2.

Group 1	**Group 2**
P. Regular expression	1. Syntax analysis
Q. Pushdown automata	2. Code generation
R. Dataflow analysis	3. Lexical analysis
S. Register allocation	4. Code optimization

   a. P-4. Q-1, R-2, S-3
   b. P-3, Q-1, R-4, S-2
   c. P-3, Q-4, R-1, S-2
   d. P-2, Q-1, R-4, S-3

3. All the regular languages can have one or more of the following descriptions:
   i) DFA ii) NFA iii) e-NFA iv) Regular Expressions. Which of the following are correct?

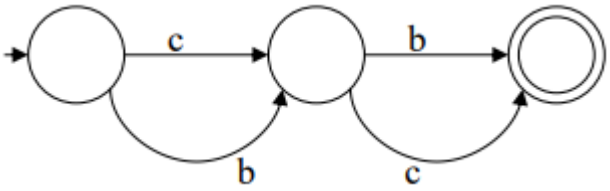
   a. i, ii, iv
   b. i, ii, iii
   c. i, iv
   d. i, ii, iii, iv

4. Finite state machine are not able to recognize Palindromes because:
   a) Finite automata cannot deterministically find the midpoint
   b) Finite automata cannot remember arbitarily large amount of data
   c) Even if the mid point is known, it cannot find whether the second half matches the first
   d) All of the mentioned

5. What is a language (in computer Science)?

   a. A language is a sequence of symbols.
   b. A language is a set of symbols.
   c. A language is a sequence of strings.
   d. A language is a set of strings.

6. If a language A is {Λ,a,b} and another language B is {Λ,0,1}, what is A.B?
   a. A.B = {Λ, a0, a1, b0, b1, 0a, 1a, 0b, 1b}
   b. A.B = {Λ, a, b, 0,1, a0, a1, b0, b1}
   c. A.B = {a0, a1, b0, b1}
   d. A.B = {a0, b1}
7. Which of the following strings CANNOT be described by the regular expression (a|b)*aaa(b)*?
   a. aaa
   b. baaab
   c. aaaaaaabbaa
   d. babaaaaaabb
8. Which of the following languages is defined by this Finite Automata given below?



   a. { cb, bc }
   b. { cc, bb, bc, cb }
   c. { c, b, cc, bb }
   d. { c, b, cc, bb, cb, bc }
9. Find a grammar for the following language: {bb, bbbb, bbbbbb, bbbbbbbb, ...}
   a. S - > b b
      S - > S b
   b. S - > b b
      S - > b b b b
      S - > b b b b b b
      S - > b b b b b b b b
   c. S - > b
      S - > S S
   d. S - > b b
      S - > b S b
10. A bottom up parser generates
    a. Right most derivation
    b. Rightmost derivation in reverse
    c. Leftmost derivation
    d. Leftmost derivation in reverse
11. A grammar that produces more than one parse tree for some sentence is called
    a. Ambiguous
    b. Unambiguous
    c. Regular
    d. None of the mentioned
12. In a compiler, keywords of a language are recognized during
    a. parsing of the program
    b. the code generation
    c. the lexical analysis of the program
    d. dataflow analysis
13. The output of lexical analyzer is
    a. A set of regular expression
    b. Syntax tress

c. Set of Token
d. String of Characters

14. Which of the following is used for grouping of characters into tokens?
    a. Parser
    b. Code optimization
    c. Code generator
    d. Lexical analyser

15. Shift reduce parsers are
    a. Top down parser
    b. Bottom up parser
    c. Maybe both
    d. None of the mentioned

16. Input to code generator
    a. Source code
    b. Intermediate code
    c. Target code
    d. All of the mentioned

17. _____ or scanning is the process where the stream of characters making up the source program is read from left to right and grouped into tokens.
    a. Lexical Analysis
    b. Diversion
    c. Modelling
    d. None of the mentioned

18. The output of a lexical analyzer is
    a. Machine code
    b. Intermediate code
    c. A stream of tokens
    d. A parse tree

19. _____ is a graph representation of a derivation
    a. The parse tree
    b. Oct tree
    c. Binary tree
    d. None of the mentioned

20. Which of these is also known as look-head LR parser?
    a. SLR
    b. LR
    c. LLR
    d. None of the mentioned

21. An LR-parser can detect a syntactic error as soon as
    a. The parsing starts
    b. It is possible to do so a left-to-right scan of the input.
    c. It is possible to do so a right-to-left scan of the input.
    d. Parsing ends

22. Which of these is true about LR parsing?
    a. Is most general non-backtracking shift-reduce parsing
    b. It is still efficient
    c. Both a and b
    d. None of the mentioned

23. Which of the following is a phase of a compilation process?
    a. Lexical Analysis
    b. Code Generation
    c. Lexical Analysis & Code Generation
    d. None of the mentioned

24. System program such a s compiler are designed so that they are
    a. Re-enterable
    b. Non reusable
    c. Serially usable
    d. None of the mentioned

25. A series of statements explaining how the data is to be processed is called
    a. Assembly
    b. Machine
    c. COBOL
    d. Program

26. Assembler is a program that
    a. Puts programs into memory and executes them
    b. Translates the assembly language into machine language
    c. Writes in high level language and produces an object program
    d. None of the mentioned
27. Which of the following is not a feature of compiler?
    a. Converts it into machine code
    b. None of the mentioned
    c. Slow for debugging
    d. Execution time is more
28. Predictive parsers can be
    a. Recursive
    b. Constructive
    c. Non recursive
    d. Both a and b
29. A Compiler has _____ phases .
    a. 7
    b. 6
    c. 8
    d. None of the mentioned
30. What value does the variable b have after ALL of the code executes?

```
int a;
int b;
a=1;
b=a++;
```

    a. 1
    b. 2
    c. 3
    d. unknown/undefined

SECTION B

Part I

1. Generate a Finite Automaton given its definition as follows: Q={A,B,C,D}, ∑ ={0,1}, q_0=A, F={D}, with a transition function δ shown in the table below **[10 Marks]**

	0	1
A	C	B
B	D	A
C	A	D
D	B	C

2. Specify a deterministic finite automaton that accepts the language of all words over Σ = {a, b} that do not contain ***bab*** (e.g., the string ***ababa*** is not contained). **[10 Marks]**

Part II

1. Let names of persons written in the English alphabets have the following structure: (i) Must be longer than two characters (ii) Must start with uppercase and all other alphabets following must also be in uppercase only or lowercase only (but not a mix). For example Kwesi and KWESI should be allowed. KwEsi should not be allowed. Based on this description, write a regular expression to identify names of persons. **[10 Marks]**
2. Consider the following email addresses: waakotam@umat.edu.gh, wa.akotam@umat.edu.gh, waakotam@umat.gh, waakotam123@umat.edu.gh, waakotam_123@umat.edu.gh.
   Write a regular expression to recognise an email written in any of the above formats. **[10 Marks]**

Part III

1. Consider the following grammar:
   Bexp → Bexp or Bterm | Bterm
   Bterm → Bterm and Bfact | Bfact
   Bfact → not Bfact | (Bexp) | id
   Use a parse tree to derive ***not id or id and id*** from the grammar above **[10 Marks]**

2. Construct an LL(1) parser table for the following grammar: **[10 Marks]**
   E → T E'
   E' → + T E' | ε
   T → F T'
   T' → * F T' | ε
   F → (E) | int

Examiner: W. A. Agangiba