Indian Institute of Technology Kharagpur
Course: MA41021/MA60001 Programing Languages
Autumn Semester 2020-21
Time : 45 minutes
Class Test - I

Declaration:

- **Each question carries 2 marks.**
- **NO query will be entertained during the examination.**
- **There may be multiple options correct for a problem. Full marks is given only when all the correct options are identified.**
- **Once a problem is passed, it will not appear in your screen again and hence if a problem appears in your screen then identify the correct option and then go for the next problem.**

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1. Consider the grammar $G = (\{E, T, A, I\}, \{a, b, +, *, -, (,)\}, R', E)$, where R' is the following set of productions:

$$E \to T \,|\, T + E \,|\, T - E$$
$$T \to A \,|\, E * T$$
$$A \to I \,|\, -A \,|\, (E)$$
$$I \to a \,|\, b \,|\, Ia \,|\, Ib$$

   Then which one of the following is true?

   (a) G is ambiguous
   (b) G is unambiguous

   Ans. a)
   Hint: ~~$E \to T + E \to E * T + E \to T * A + T \to A * I + A \to I * b + I \to a * b + a$~~ and

   ~~$E \to T \to E * T \to E * T + E \to T * A + T \to A * I + A \to A * b + A \to I * b + I \to a * b + a$~~
   $E \to T \to E * T \to T + E * T \to A + T * A \to I + A * A \to I + I * I \to a + b * a$ and
   $E \to T + E \to T + T \to T + E * T \to A + T * A \to I + A * A \to I + I * I \to a + b * a$

2. Which one of the following is true?

   (a) The advantage of a *purely compiled implementation* is *flexibility*
   (b) The advantage of a *purely interpreted implementation* is *flexibility*

   Ans. ~~a)~~ b)

3. Consider a memory with 4 memory addresses each of which corresponds to a cell which stores 12 bits of data. Then the number of bits of data the memory can store is

(a) 48

(b) 2^{14}

ANS a)

4. Consider the contextfree grammar $G = (\{E\}, \{a, b\}, R, E)$ where R is defined by the $E \to aEE \,|\, b$. Then the statement "*aabbababb* is a legal string in the language defined by G" is

   (a) True

   (b) False

   ANS a)

5. Which of the following are true?

   (a) A compiler translates the program written in a high level language line by line

   (b) A compiler translates program written in a high level language by one step without any further processing into another language

   (c) An interpreter is not included as a step when a compiler translates the program written in a high level language into an object code

   (d) An interpreter converts the source program written in a high level language line by line when the program is run

   ANS c)

6. Which of the following are true?

   (a) The operations on primitive data are processed by ALU and IR in an abstract machine

   (b) The PC register in an abstract machine stores the primitive data of a program

   (c) None of the above

   ANS: c)

7. The number of bits needed to store memory addresses of a memory that contains precisely 8192 bits of data with each cell containing 4 bits of data, is

   (a) 8

   (b) 10

   (c) 11

   (d) 12

   ANS c)

8. Consider the grammar $G = (\{E, T, F, I\}, \{a, b, c, +, *, (,)\}, R, E)$ where R is given by

$$E \to T \,|\, E + T, T \to F \,|\, T * F, F \to I \,|\, (E), I \to a \,|\, b \,|\, c.$$

   Then number of different derivation trees for $(((a + b) * c)) + a + b$ is

   (a) 1

   (b) > 1

   ANS a)

9. Consider a grammar $G = (\{E\}, \{a, b\}, R, E)$ where R is described by $E \to aEa \,|\, bEb$. Then the statement "language defined by G consists of all palindromic strings containing terminal symbols a, b" is

   (a) True

   (b) False

   ANS b)

10. In the logical structure of the compiler, the step in which the decision about which process registers are to be used for storing which variables is done by

    (a) Lexical Analysis

    (b) Semantic Analysis

    (c) Optimisation

    (d) Code Generation

    ANS d)