

III B. Tech I Semester Regular Examinations, November - 2015
PRINCIPLES OF PROGRAMMING LANGUAGES

(Computer Science and Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answering the question in **Part-A** is compulsory
 3. Answer any **THREE** Questions from **Part-B**

PART -A

- | | | | |
|---|----|--|------|
| 1 | a) | What constitutes a programming environment? | [3M] |
| | b) | What mixed-mode assignments are allowed in C and Java? | [4M] |
| | c) | What is an alias? What are the problems associated with it? | [4M] |
| | d) | What is attribute grammar? Explain how attribute grammar is use for evaluation of the expressions. | [4M] |
| | e) | What is type inferencing used in ML? | [3M] |
| | f) | What is the difference between checked and unchecked exception in java? | [4M] |

PART -B

- | | | | |
|---|----|--|-------|
| 2 | a) | What is the difference between a sentence and a sentential form in a CFG? | [4M] |
| | b) | Explain with an example how the weakest precondition for a logical pretest loop is derived. | [8M] |
| | c) | A concise and understandable description of a programming language is essential to the language's success. Comment on this. | [4M] |
| 3 | a) | What are the merits of sub range types? | [3M] |
| | b) | Explain in detail various design issues of character string types. | [8M] |
| | c) | What is a variable and what are the attributes of a variable? Elaborate on address of a variable. | [5M] |
| 4 | a) | Discuss the following term:
i) Dangling pointers, ii) Tail recursion elimination. | [10M] |
| | b) | Explain associative arrays, their structure and operations. | [6M] |
| 5 | a) | What is the difference between the way original C and C89 deal with an actual parameter whose type is not identical to that of the corresponding formal parameter? | [8M] |
| | b) | Discuss in detail overloaded operators. | [8M] |
| 6 | | Discuss how producer-consumer problem and Dining philosopher's problem are solved using concurrency in ADA. | [16M] |
| 7 | a) | For what sort of application logic programming is useful? Briefly explain. | [8M] |
| | b) | What are existential queries? Briefly explain. | [8M] |

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PART -A

- 1 a) What do you mean by a general purpose language? Is C a general purpose language? [3M]
 b) Give an example of left recursive rule in CFG. What is the significance of left recursive rule? [4M]
 c) What do you mean by binding? Give examples of some of the bindings and their binding times. [4M]
 d) Consider the following C program: [4M]

```
int fun(int _ i) {
    *i+=5;
    return 4;
}
void main {
    int x=3;
    x=x+fun (&x)
}

```

 What is the value of x after assignment statement in main method assuming i. operands are evaluated left to right?
 e) What are advantages and disadvantages of dynamic local variables? [3M]
 f) What is type inferencing used in ML? [4M]

PART -B

- 2 a) Explain the process of compilation in each phase of a compiler. [8M]
 b) Give some reasons why computer scientists and professional software developers should study general concepts of language design and evaluation. [8M]
- 3 a) Discuss about Context-free grammar and regular expression? Give the parse tree of a following statement: $A = (B+C) * (D / E)$. [8M]
 b) Consider the following pseudo code. [8M]

```
Procedure P (A, B: real)
X: real
Procedure Q (B, C: real)
Y: real
...
Procedure R (A, C: real)
Z: real
... (*)
...

```

 Assuming static scope, what is the referencing environment at location marked by (*)?

- 4 a) Explain in detail arrays, indices, subscript bindings, and array categories. [8M]
b) What are the problems posed by managing a heap of single-size cell and variable-size cell? Explain in detail various methods for reclaiming garbage. [8M]
- 5 a) Discuss precedence and associativity rules of different programming languages. [8M]
b) Explain in detail multiple selection constructs. [8M]
- 6 a) What are the characteristics of co-routine feature? List the languages which allow co-routines. [8M]
b) How to implement generic functions in C++? [8M]
- 7 a) Define monitor? Explain how cooperation synchronization and competition synchronization are implemented using monitors. [8M]
b) Write a prolog description of your family tree (based only on facts), going back to your grandparents and including all descendants. Be sure to include all relationships. [8M]

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PART -A

- | | | | |
|---|----|---|------|
| 1 | a) | Differentiate between Hybrid Interpretation and Pure Interpretation. | [3M] |
| | b) | Write short notes on Short Cut evaluation. | [4M] |
| | c) | What are the design issues for exception handling in JAVA? | [3M] |
| | d) | Differentiate In mode and Out Mode parameter passing mechanisms. | [4M] |
| | e) | With respect to the object oriented programming, briefly explain virtual functions. | [3M] |
| | f) | What are the three features of Haskell that makes very different from schema? | [4M] |

PART -B

- | | | | |
|---|----|--|------|
| 2 | a) | What are the main features of the programming paradigm with examples? | [8M] |
| | b) | Define CFG? What does it mean for CFG to be ambiguous? | [8M] |
| 3 | a) | (i) Explain Dijkstra's selection construction and loop structure. | [8M] |
| | | (ii) Explain with examples user-located loop control mechanisms provided by various languages. | |
| | b) | What is meant by type checking? Differentiate between static type checking and dynamic type checking and give their relative advantages. | [8M] |
| 4 | a) | Discuss the significance of holes in the records. Why they do and what problem do they cause? | [8M] |
| | b) | Explain the difference between virtual and non-virtual methods. | [8M] |
| 5 | a) | Describe three alternative means of allocating co-routine stacks. What are their relative strengths and weaknesses? | [8M] |
| | b) | What is dangling-else problem? Discuss How it can be handled by the programming language. | [8M] |
| 6 | | Explain the following terms : | |
| | a) | Message passing | [6M] |
| | b) | Concurrency in Ada | [5M] |
| | c) | Monitors. | [5M] |
| 7 | a) | For what sort of application logic programming is useful? Briefly explain. | [8M] |
| | b) | Write a LISP function fib(n) that computes nth Fibonacci number. | [8M] |

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PART -A

- | | | |
|---|--|------|
| 1 | a) Briefly write about Virtual Machines. | [3M] |
| | b) What are the advantages of user-defined data types? | [4M] |
| | c) How does C support relational and Boolean expressions? | [3M] |
| | d) Explain with example how operand-evaluation order interacts with functional side effects. | [4M] |
| | e) Write a short note on 'this' pointer in C++. | [3M] |
| | f) Explain about LISP interpreter. | [4M] |

PART -B

- | | | |
|---|---|-------|
| 2 | Explain language evaluation criteria and the characteristics that affect them. | [16M] |
| 3 | a) Define syntax and semantics. | [5M] |
| | b) The levels of acceptance of any language depend on the language description. Comment on this. | [5M] |
| | c) Define grammars, derivation and a parse tree. | [6M] |
| 4 | a) What are dangling pointers and lost heap-dynamic variables? How are they created? | [8M] |
| | b) What are the problems posed by managing a heap of single-size cell and variable-size cell? Explain in detail various methods for reclaiming garbage. | [8M] |
| 5 | Discuss about the various attributes of a good language and explain the process of evaluating attributes with example. | [16M] |
| 6 | a) Write an analysis of the similarities and differences between java packages and C++ namespaces. | [8M] |
| | b) Explain how information hiding is provided in an ADA package. | [8M] |
| 7 | a) Discuss about basic elements of prolog. Give examples. | [8M] |
| | b) Explain how data abstraction is implemented in ADA. | [8M] |

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PART -A

- | | | |
|---|---|------|
| 1 | a) Define Left Recursive Grammar Rule. | [4M] |
| | b) Define Binding and Binding Time. | [3M] |
| | c) Which languages allow variable number of parameters? | [3M] |
| | d) What is an overriding method? | [4M] |
| | e) What data types were parts of original LISP? | [4M] |
| | f) What are two parts of a compound term? | [4M] |

PART -B

- | | | |
|---|---|-------|
| 2 | Using this grammar $\langle \text{assign} \rangle \rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle$
$\langle \text{id} \rangle \rightarrow \text{A B C}$
$\langle \text{expr} \rangle \rightarrow \langle \text{id} \rangle + \langle \text{expr} \rangle \langle \text{id} \rangle * \langle \text{expr} \rangle (\langle \text{expr} \rangle) \langle \text{id} \rangle$
Show parse tree and Left most derivation for following:
(a) $A = (A+B)*C$ (b) $A = B*(C*(A+B))$ | [16M] |
| 3 | a) Define name and structure type compatibility. What are relative merits of these two? | [8M] |
| | b) Define Coercion, Typeerror, Typechecking and Strong Typing. | [8M] |
| 4 | a) Explain design issues of functions. | [6M] |
| | b) Explain about Co-Routines with an example. | [10M] |
| 5 | a) What is Co-Operation Synchronization? | [6M] |
| | b) Implement Producer and Consumer problem using Semaphores. | [10M] |
| 6 | a) Explain about data objects in LISP. | [12M] |
| | b) Write factorial function using COMMON LISP. | [4M] |
| 7 | a) Explain Inferencing process of PROLOG. | [10M] |
| | b) Write differences between procedural and non-procedural languages. | [6M] |

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PART -A

- | | | | |
|---|----|--|------|
| 1 | a) | Define Lexeme and Token. | [3M] |
| | b) | Define row major order and column major order in arrays. | [3M] |
| | c) | Write differences between function and procedure. | [4M] |
| | d) | Briefly describe advantage of monitor over semaphores. | [4M] |
| | e) | Write difference between EQ and EQV. | [4M] |
| | f) | What are forms of Horn Clauses? | [4M] |

PART -B

- | | | | |
|---|----|--|-------|
| 2 | a) | Prove that the following grammar is ambiguous
$\langle S \rangle \rightarrow \langle A \rangle$
$\langle A \rangle \rightarrow \langle A \rangle + \langle A \rangle \langle id \rangle$
$\langle id \rangle \rightarrow alblc$ | [8M] |
| | b) | What is primary use of attribute grammar? | [8M] |
| 3 | a) | Explain Categories of Arrays. | [8M] |
| | b) | Explain Array Operations. | [8M] |
| 4 | | Explain different parameter passing methods with an example. | [16M] |
| 5 | a) | Explain Thread class in JAVA and its methods. | [10M] |
| | b) | Explain how concurrency is provided in ML. | [6M] |
| 6 | a) | Explain about Predicate functions in Scheme. | [8M] |
| | b) | How functions are defined in Scheme? | [8M] |
| 7 | a) | Explain about fact and rule statements in PROLOG | [8M] |
| | b) | Explain how backtracking works in PROLOG | [8M] |

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PART -A

- | | | | |
|---|----|---|------|
| 1 | a) | Draw Parse tree for expression $a=b/(a+c)$. | [3M] |
| | b) | Define narrowing and widening conversions. | [3M] |
| | c) | What is parameter profile? | [4M] |
| | d) | Write differences between logical and physical concurrency. | [4M] |
| | e) | What does a lambda expression specify? | [4M] |
| | f) | What are three forms of PROLOG Term? | [4M] |

PART -B

- | | | | |
|---|----|--|-------|
| 2 | a) | Describe purpose of ACTION and GOTO table in an LR Parser with example. | [10M] |
| | b) | Describe differences between Top-Down and Bottom-Up Parsers. | [6M] |
| 3 | a) | What is mixed mode assignment? Explain mixed mode assignments in Ada, Java and ML. | [10M] |
| | b) | Explain structure of an associative array. | [6M] |
| 4 | a) | What is an overloaded subprogram? Explain with an example. | [8M] |
| | b) | Explain two methods for implementing blocks. | [8M] |
| 5 | | What is exception handling? How exceptions are handled in C++ and JAVA. | [16M] |
| 6 | a) | Explain about list functions in Scheme. | [8M] |
| | b) | Explain about primitive functions in Scheme. | [8M] |
| 7 | a) | Write deficiencies of PROLOG. | [10M] |
| | b) | Explain generate and test programming strategy in PROLOG. | [6M] |

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PART -A

- | | | | |
|---|----|--|------|
| 1 | a) | What is primary task of a Lexical Analyzer? | [3M] |
| | b) | What are design issues of Two-Way Selection Statement? | [3M] |
| | c) | Define scope and Lifetime. | [4M] |
| | d) | Explain wait () and release () methods of semaphores. | [4M] |
| | e) | What are antecedents and consequents? | [4M] |
| | f) | What are two forms of DEFINE? | [4M] |

PART -B

- | | | |
|---|--|-------|
| 2 | Perform Pair wise disjointness test for following rules: | [16M] |
| | A → aB bcBB | |
| | B → aB bAlaBb | |
| | C → aaAl caB | |
| 3 | a) Explain advantages and disadvantages of Java for loop compared to Ada for loop. | [8M] |
| | b) Explain about Guarded Command | [8M] |
| 4 | Describe deep access and shallow access methods for implementing dynamic scoping. | [16M] |
| 5 | a) Explain features of Object-Oriented Programming Languages. | [6M] |
| | b) Explain how Ada supports concurrency. | [10M] |
| 6 | Explain how functions are defined in Scheme and ML. | [16M] |
| 7 | Explain list structures and Goal statements in PROLOG. | [16M] |

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PART -A

- 1 a) What are the factors influencing the writability of a language? [4M]
- b) List the advantages of using control structures in any of the compiled programming languages. [3M]
- c) Define Shallow and Deep binding for referencing environment of subprograms that have been passed as parameters. [4M]
- d) Describe briefly about Monitors. [4M]
- e) Write about Meta Language declaration statements. [4M]
- f) What is the relationship between resolution and unification in Prolog? [3M]

PART -B

- 2 a) Compare and contrast between the special purpose and general purpose programming languages. [4M]
- b) What is attribute grammar? Give the syntax directed definition for a desktop calculator. [8M]
- c) What are the limitations of recursive descent parser? [4M]
- 3 a) Explain the conditional statements and its implementation with examples. [8M]
- b) Explain the scope and lifetime of variables. Illustrate when they would coincide and when they don't. [8M]
- 4 a) Define a subprogram. Write the semantics of call and return of a subprogram. [8M]
- b) Discuss about nested subprograms with examples. [8M]
- 5 a) How message passing is implemented in Ada? Explain with examples. [8M]
- b) What is an event? How the events are handled in various OOP languages. [8M]
- 6 a) Discuss the fundamental concepts of lambda calculus. [8M]
- b) Explain about LISP functional programming language. [8M]
- 7 a) Discuss about basic elements of Prolog. [8M]
- b) Explain different types of propositions present in logic programming. [8M]

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PART -A

- 1 a) Describe the approach of using axiomatic semantics to convert the correctness of a given program? [4M]
 b) List the advantages and disadvantages of mixed mode arithmetic expressions. [4M]
 c) Why is type checking the parameters of a subprogram important? [3M]
 d) What is the primary problem with semaphores to provide synchronization? [4M]
 e) Write a short note on ML functions. [4M]
 f) What are the syntactic form and usage of fact and ruled statements in Prolog? [3M]

PART -B

- 2 a) How do you describe the meanings of programs using dynamic semantics? [4M]
 b) Explain in detail about recursive descent parsing. [8M]
 c) Give an example of left recursive rule in CFG. What is the significance of left Recursive rule? [4M]
- 3 a) Explain about the following [8M]
 i) associative arrays ii) union types
 b) State whether static binding is more reliable or dynamic binding. Justify. [8M]
- 4 a) Define a function. What are the design issues for functions? Explain. [8M]
 b) Explain how subprogram is overloaded? Give examples. [8M]
- 5 a) Compare and contrast the cooperation synchronization and competition synchronization in message passing. [8M]
 b) Explain the basic concepts of exception handling. [8M]
- 6 a) How ML is different from other functional programming languages? [8M]
 b) Why were imperative features added to most dialects of LISP? [8M]
- 7 a) Explain how RDBMS and expert systems are helped using logic programming. [8M]
 b) Discuss Terms and Goal statements in Prolog with examples. [8M]
