Birla Institute of Technology and Science, Pilani

Department of Computer Science and Information Systems

Semester I (2020-21)

Principles of Programming Languages (CS F301)

Tutorial sheet (#3)

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1. Design the grammar for deriving modular programs, where a program should have one driver module (use the keyword DRIVER to specify) and any number of other modules without the keyword DRIVER. All other modules should precede the driver function definition. A program may or may not have any modules. The driver function is essential. Use <statements> construct to specify the internal structure of a module. [You need not go for rules for individual statement constructs in this question]

2. Write the grammar rules for the iterative statements while and for in a C-like language. Verify that the grammar is not ambiguous.

3. A language supports single dimensional arrays and declares variables of array type as follows

   Declare a, b, c: array [12..20] of real;

   Declare d, e: array [low..high] of integer;

   Where .. is the range operator. The variables low and high specify the valid indices an array element can use, e.g. d[low], a[13], c[20] etc. are the valid accesses while b[10], a[24], e[high+1] etc. are not valid accesses. The pair (low, high) and basic element type define the array type. The range can be defined using any positive integer or a variable name. The keywords used are 'Declare', 'of', 'real' and 'integer'. The special symbols used are {, ,:, [,], ;} tokenized as COMMA, COLON, SQ_OP, SQ_CL and SEMICOLON respectively.

   Write the grammar rules for the declaration statement for declaring variables of the array type as described above. [You can use the names of the nonterminals describing the constructs of list, range and declaration statement as <L>, <R> and <DS> respectively, where the range is enclosed within the square brackets as above]

4. Draw the parse tree for the two declaration statements given in Q3. And verify that your grammar is not ambiguous.

5. Write C code for allocating memory to an array of 'n' records, where each record defines the fields name, age, ID_last4digits, date_of_birth using appropriate types. Write high level abstractions for the record as 'info' and write functions to populate the records in the array. The value of 'n' is known at run time. Discuss the allocation of space in memory.

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