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Question Paper Code : 90421

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Computer Science and Engineering

CS 8602 — COMPILER DESIGN

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Write a regular expression to represent all possible numbers (integer, float, and exponential)
2. How and why input buffering is occurring?
3. Write down the context-free grammar for representing the if-else statement of any language.
4. Write LMD for the word $(i+i)/(i*i)$ using the grammar,
 $E \rightarrow E + E \mid E / E \mid E * E \mid (E) \mid i$
5. What is the use of a Three Address Code?
6. What is type-checking?
7. How is the liveness of a variable calculated?
8. List the different types of storage allocation strategies.
9. Define constant folding.
10. What is the difference between peephole optimization and normal optimization?

PART B — (5 × 13 = 65 marks)

11. (a) An online shopping site has set up the following criteria for setting the password for viewing their products
- (i) Password should be 3 to 5 characters long using alphabets and numerals.
 - (ii) It should start with alphabet
 - (iii) Two special symbols (% and #) are permitted
 - (iv) At least one capital letter should be present

Assume the password given by the user has to be scanned by the first phase of the compiler. Represent the above in an appropriate format and convert it into a finite state machine.

Or

- (b) What are the five token formats of a programming language? Represent each token format using regular expression and draw equivalent finite automata.
12. (a) Construct LR (0) items for the following grammar, G :

$S \rightarrow S + R \mid R$
 $R \rightarrow R * T \mid T$
 $T \rightarrow (S) \mid i$

Or

- (b) Construct LL(1) parsing table for the following grammar, G and check whether the word "ia<btd" is a string of the grammar or not

$S \rightarrow iEtS \mid iEtSeS \mid d$
 $E \rightarrow id \mid OP \mid id$
 $OP \rightarrow < \mid > \mid < = \mid > = \mid = = \mid !=$

13. (a) Write the semantic actions for the declaration statements in the following piece of code. Show the symbol tables created.

```
Procedure a ( )
```

```
{
```

```
    int a, b;
```

```
    float c;
```

```
    procedure b ( )
```

```
    {
```

```
        int a ;
```

```
        float c;
```

```
        procedure c ( )
```

```
        {
```

```
            int d;
```

```
        }  
    }  
}
```

Or

- (b) Translate the following piece of code into Three Address Codes using syntax-directed translation.

```
Count := 0;
```

```
read x;
```

```
if (x > 0 && x < 10)
```

```
then
```

```
    count := count + 1;
```

```
    read x;
```

```
else
```

```
    count := 0;
```

```
endif.
```

14. (a) (i) Elaborate on the issues in the design of code generator. (7)
(ii) Write the algorithm used in code generation phase of compiler. (6)

Or

- (b) Elaborate on the storage allocation strategies.

15. (a) What are the principal Sources of Optimization? Explain the local optimization strategies with appropriate examples.

Or

- (b) What is a peephole? Explain the optimizations that can be performed on a peephole

PART C — (1 × 15 = 15 marks)

16. (a) For calculating the income tax, the following formulae is used by a concern.

$$\text{Tax} = (\text{basic_pay} + \text{DA} + \text{HRA}) * 0.3$$

Where,

basic_pay is an integer value and DA and HRA could be either integer or floating point numbers.

Elaborate on how this statement is converted into a machine language format while passing through the six phases of the compiler. Elaborate on the process by giving the output. Write the use of symbol table and error handling phase too.

Or

- (b) For calculating the income tax, the following formulae is used by a concern.

if salary > 500000 then

$$\text{Tax} = \text{salary} * 0.20$$

Else

$$\text{Tax} = \text{salary} * 0.10$$

End if

where,

salary could be either integer or floating point number.

Elaborate on how this statement is converted into a machine language format while passing through the six phases of the compiler. Elaborate on the process by giving the output. Write the use of symbol table and error handling phase too.