B/C 2
F- First floor

Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

END SEMESTER EXAMINATION

B. E. (Final Year): Semester-I (2018/19) (COE/SEM)	Course Code: UCS802
	Course Name: Compiler Construction
December 08, 2018	SATURDAY, 0900 – 1200 Hrs
Time: 3 Hours, M. Marks: 100	Name Of Faculty: AA, KAR, SUG, GTK

Note: ***Attempt all questions***
Assume missing data, if any, suitably

Q.1 (a) Consider the following translation scheme for grammar $G = \{\{N, D, B\}, \{\mathbf{0}, \mathbf{1}, .\}, N, \{P\}\}$, where P is given as.

$$N \rightarrow D_1 . D_2 \left\{N.\mathbf{val} = D_1.\mathbf{val} + \frac{D_2.\mathbf{val}}{2^{D_2.\mathbf{len}}}\right\}$$

$$D \rightarrow D_1 B \{D.\mathbf{val} = 2 * D_1.\mathbf{val} + B.\mathbf{val}\}\{D.\mathbf{len} = D_1.\mathbf{len} + 1\}$$

$$D \rightarrow B \{D.\mathbf{val} = B.\mathbf{val}\}\{D.\mathbf{len} = 1\}$$

$$B \rightarrow \mathbf{0} \{B.\mathbf{val} = 0\}$$

$$B \rightarrow \mathbf{1} \{B.\mathbf{val} = 1\}$$

In the above grammar, **val** is synthesized attribute of $N, D,$ and B, whereas, **len** is synthesized attribute of D. Remove left recursion from the above grammar to make it suitable for top-down parsing. (12)

(b) Evaluate the value of 1011.1101 using top-down parsing. Draw the annotated parse tree for the same. (08)

Q.2 (a) Consider the flow diagram given below.

```
        x = 3;
        y = 2;
L1:     a = 5.2;
        b = 9.4;
        if (a > 5)
                k = x * y;
                c = 3.8;
        else
                m = x * y;
        a = y + b;
        k = x * y;
        d = c * 2;
        goto L1;
```

Can we apply any of the following optimization technique on it? Justify your answer with proper reasoning:

i) Common Subexpression Elimination ii) Dead code elimination
iii) Constant Propagation iv) Frequency reduction (4)

(b) Using suitable examples, differentiate between

i) Synthesized and Inherited attributes
ii) Dependency graph and Annotated Parse tree (10)

(c) Given brief reasons (in favor or against) for each of the following statements (6)

i. The size of SLR(1) table and LALR(1) table for the same grammar are identical.

ii. While parsing a sentence of a language, the behavior of LR(1) parser and LALR(1) parser are identical.

Q.3 (a) Explain in brief the different ways of passing the parameters to the procedure with help of some examples. (10)

(b) Consider the following function definitions

```
int z = 2;
void h(int);
void g(int);
void f(int);
int main()
{
        g(z);
        return 0;
}
void f(int n)
{
        static int x = 1;
        g(n);
        x − −;
}
void h(int p)
{
        static int x = 1;
        g(p);
        x − −;
}
```

```
void g(int m)
{
        int y = m − 1;
        if(y ≥ 1)
        {
                f(y);
                z − −;
                g(y);
        }
        else if (y ≥ 0 && y < 1)
        {
                h(y);
                z − −;
                g(y);
        }
}
```

Show through diagram the runtime environment for the above function execution. (10)

Q.4 (a) Consider the following grammar $G = \{\{S, A\}, S, \{\boldsymbol{a}, \boldsymbol{b}, \boldsymbol{c}, \boldsymbol{d}\}, P\}$, where P is set of productions as: (10)

$$S \rightarrow A\boldsymbol{a} \mid \boldsymbol{b}A\boldsymbol{c} \mid \boldsymbol{dc} \mid \boldsymbol{bda}$$

$$A \rightarrow \boldsymbol{d}$$

Construct the Canonical LR(1) set for the grammar.

(b) Construct the parsing table for the above grammar. (5)

(c) Parse the string "bdc" in a tabular form showing the stack configuration, input symbols and outputs (5)

Q.5 (a) Consider a regular expression $(a|b)^*a(a|b)(a|b)$. Construct minimized DFA direct from the above regular expression without constructing NFA. (16)

(b) Describe various error recovery strategies that can be adopted at various stages of compiler design. (4)

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The schedule of showing the evaluated answer sheets will be shown on the course website at http://bit.ly/ucs-802