BITS Pilani, Dubai Campus, DIAC, Dubai.
III Year   SECOND Semester   2013-2014
Degree: B.E.(Hons.).   Branch: C.S.
Comprehensive Examination Question Paper

Course No : CSC 362   Course Title: Programming Languages and Compiler Construction
Date: 22/05/14   Thursday   Time: 12.30 – 3.30 pm   Total marks: 40
Data provided are complete. *Closed Book*.
This question paper has 4 pages.

Answer **all** Questions.

1. What does the ATTRIBUTE INFORMATION in SYMBOL TABLE contain?
(Note: in this context attributes are internal representations of declarations)   [2 M]

2.Translate the following program segment into Three Address Code (Quadraples):

```
        begin
            while ( i < 100)
                begin
                    k = k + 2
                    j = k + 6
                    i = i + 4
                end
            j = j + 1
        end
```
Assume that *i,j,k* are all integers whose initial values are zero.   [3 M]

3. Break the following program into BASIC BLOCKS and Write them separately.

```
1.  m ← 1
2.  v ← 0
3.  if  v >= n goto 15
4.  r ← v
5.  s ← 1
6.  if r < n goto 9
7.  v ← v + 1
8.  goto 3
9.  x ← M[r]
10. s ← s + x
11. if s <= m goto 13
12. m ← s
13. r ← r + 2
14. goto 6
15. return m                                                  [3 M]
```

P.T.O.

4. Explain the following kinds of EXPRESSIONS w.r.t intermediate
    representation tree (.**IR TREE**)::
   - TEMP(t)
   - MEM(e)
   - CALL(f, l)
   - NAME(n)

                                                                    [4 M]

5. Draw the **Control Flow Graph** and **Discuss** the Liveness of the variables **a, b, c** for
the following program segment:

$$a \leftarrow 1$$
L_1: $b \leftarrow a+2$
    $c \leftarrow c+b$
    $a \leftarrow b * 4$
    if $a < N$ goto L_1
    return c

(assume that the variable **c** is live on entry to the above program segment and assume it to
be a formal parameter.)   [4 M]

6. Consider a *simple assignment statement*:

$$d := (a+1) + (a + 5) + (c + e)$$

You are required to **generate CODE** for the above statement   using a simple code
generation algorithm and tabulate your steps as shown below:

Statements	Code Generated	Register Descriptor	Address Descriptor
....	....	....	....
....	....	....	....
....	....	....	....

                                                                    [4 M]

7. Write the algorithms (or methods) for the **Mark** and **Sweep** Phases in Mark & Sweep
Garbage Collection.   [3 M]

                            P.T.O.

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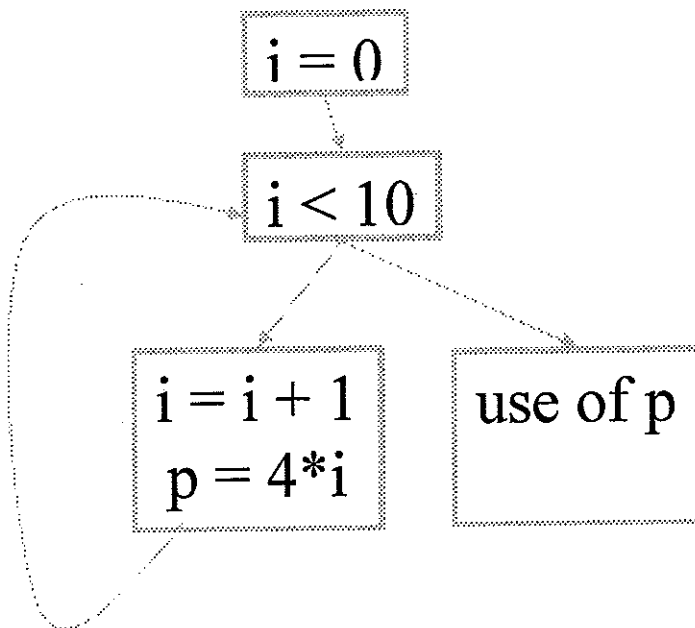8. Draw an Interference Graph (in Register Allocation) for the following Instructions:
[2 M]

b = a + 2

c = b * b

b = c + 1

return b * a

9. Perform Code Optimization, if any, in the following segment, shown in the following Program Flow Graph (you need to draw the transformed graph after optimization):   [2 M]

$$i = 0$$

$$i < 10$$

$$i = i + 1$$
$$p = 4*i$$

use of p

10. Consider the following SWI PROLOG Program

```
t(1, Val)  :- Val is 0.
t(N, Val)  :- N > 0,
          N1 is N-1,
          t(N1, Smallval),
          Val is (Smallval + N1 * N).
```

When n=1, 2 what are the values for the output variable Val?   (2 M)
P.T.O.

11.Find the NULLABLE, FIRST and FOLLOW sets for the following CFG and then
Construct the PREDICTIVE PARSING TABLE: [7 M]

$S \rightarrow W$

$S \rightarrow X$

$W \rightarrow M;$

$W \rightarrow ;$

$X \rightarrow$ **while** (M) S

$X \rightarrow$ **for** $(M;M;M)$ S

$M \rightarrow N$

$N \rightarrow PUT$

$P \rightarrow Q$

$Q \rightarrow R$

$R \rightarrow$ **a**

$R \rightarrow T$

$T \rightarrow$ **5**

$U \rightarrow =$

$Y \rightarrow \epsilon$

Note: Here, ϵ indicates null

12. Write the output for the following JAVA program: (4 M)

```java
import java.io.*;
public class C
{
  public static void main (String[] args)
  {
    for (int i = 1; i <= 10; i++)
      {
      System.out.print (ca (i) + " ");
      }
    System.out.println ();
  }
  public static int ca (int n)
  {
    if ( n < 0 ) throw new IllegalArgumentException();
    if (n < 2)
      return 1;
    int sum = 0;
    for (int i = 1; i <= n; i++)
      sum += ca (i - 1) * ca (n - i);
    return sum;
  }
}
```

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BITS Pilani, Dubai Campus, Dubai International Academic City
III Year SECOND SEMESTER   2013-2014
Degree: B.E. (Hons.) Branch: C.S.
TEST I Question Paper
Course No : CS F363   Course Title: Compiler Construction
Date: 24 April., 2014 Sunday   Time: 50 minutes   Total marks: 20
Data provided are complete. **Closed** *Book*. This qn paper has 1 page.

Answer all Questions.

1. Give an example in each category for the following errors:
   a) LEXICAL ERROR   b) SYNTAX ERROR
   c) SEMANTIC ERROR   d) LOGICAL ERROR

   [2 M]

2. Eliminate Left Recursion And Perform Left Factoring, if applicable, for the following CFG:

$$S \rightarrow (L) \mid a$$
$$L \rightarrow L, S \mid S$$

   [2 M]

3. Explain Shift-Reduce Conflict with an example.   [3 M]

4 a) Write YACC specification [source] for the following CFG:

$$S \rightarrow ABbC$$
$$A \rightarrow a \mid CB \mid \epsilon$$
$$B \rightarrow C \mid d4a \mid \epsilon$$
$$C \rightarrow e \mid f \mid \epsilon$$

   (4M)

   b) Which of the following **input strings**, satisfy the above grammar?
   1) **be**   2) **adaabe** 3) **daabe**   4) **fbe**   (1 M)

5. Find the NULLABLE, FIRST and FOLLOW sets for the following CFG and then Construct the PREDICTIVE PARSING TABLE: [8M]

$$X \rightarrow S\$$$
$$S \rightarrow id(L);$$
$$S \rightarrow if (E) S \text{ else } S$$
$$L \rightarrow \epsilon$$
$$L \rightarrow E C$$
$$C \rightarrow \epsilon$$
$$C \rightarrow , E C$$
$$E \rightarrow id$$
$$E \rightarrow num$$

Note: Here, $ indicates END OF INPUT. ϵ indicates null.

BITS Pilani, Dubai Campus, Dubai International Academic City
III Year   SECOND SEMESTER   2013-2014
Degree: B.E. (Hons.) Branch: C.S.
TEST I Question Paper
Course No : CSUC362   Course Title: Programming Languages and Compiler Construction

Date: 24 April., 2014 Sunday   Time: 50 minutes   Total marks: 25

Data provided are complete. **Closed** *Book*. This qn paper has 2 pages.

Answer all Questions.

1.   Consider the following LISP Program:

```
   (de a(n)
 ( if (= n 1)
    1
   ( +  ( *  2    (a(- n 1))  )  1 )
) )
```

Write the result (output) of each of the following LISP Expressions for the above code:
i) **(a 7)**   ii) **(a 8)**   iii) **(a 9)**   [3 M]

2. Differentiate between Declarative and Imperative Programming paradigms. [2 M]

3. Give an example in each category for the following errors:
   a) LEXICAL ERROR   b) SYNTAX ERROR
   c) SEMANTIC ERROR   d) LOGICAL ERROR
                                                        [2 M]

4. Eliminate Left Recursion And Perform Left Factoring, if applicable, for the following CFG:

$$S \rightarrow (L) \mid a$$
$$L \rightarrow L , S \mid S$$ [2 M]

5.Explain Shift-Reduce Conflict with an example.   [3 M]

Qn paper

6. SHIFT-REDUCE PARSING ACTIONS in a tabular form   [5 M]

Consider the following CFG:

$E \rightarrow E + E$

$E \rightarrow E * E$

$E \rightarrow (E)$

$E \rightarrow id$

You are given the following input string: **(id1 * id2) + (id3 + id4)**

Now, **Tabulate** the SR parsing actions for the above input string as shown below:

STACK	INPUT	ACTION
....	....	....
....	....	....

7. Find the NULLABLE, FIRST and FOLLOW sets for the following CFG and then Construct the PREDICTIVE PARSING TABLE: [8M]

$X \rightarrow S\$$

$S \rightarrow id(L);$

$S \rightarrow if (E) S \, else \, S$

$L \rightarrow \epsilon$

$L \rightarrow E \, C$

$C \rightarrow \epsilon$

$C \rightarrow , E \, C$

$E \rightarrow id$

$E \rightarrow num$

Note: Here, $ indicates END OF INPUT. ϵ indicates null.

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Qnpaper