

Programming Languages

Midterm Exam II
December 5, 2001
(100 pts.)

<i>Last name:</i>	<i>First name:</i>	<i>Social Security:</i>

1. (30 pts.) Define scope and lifetime of a variable. Explain differences and give examples?

2. (70 pts.) [SIMPLESEM] Consider the following program:
- (15 pts.) Augment its code with comments describing the distance $df(f)$ of all function calls and the distance $dv(x)$ of all variables.
 - (35 pts.) Write a complete SIMPLESEM code for the above program using the C4 language paradigm. Enter your *code* and *comments* in the table provided below. Use pencil so that you can easily make necessary corrections. Use the frame pointer function $fp()$ wherever needed (instead of using $D[\dots]$).
 - (20 pts.) Describe the state of the data segment (and all of its *intermediate* states) for the above program right after the THIRD call to $f()$ and following the assignment “ $\text{int } s=3$ ”. Enter *numbers* and *comments* in the table provided below . Use pencil so that you can easily make necessary corrections.

```

main()
{
    int s=1, q=2;
    int f()
    {
        int s=3;
                                <--- End of data segment following
                                <--- the third call to f()

        int g()
        {
            label_two:
            if ( s >= q )
            {
                s = s - 1;
                q = q + 1;
                goto label_two;
            }
            else return f();
        }

        label_one:
        if ( s < q )
        {
            q = q - 2;
            goto label_one;
        }
        else return g();
    }
    s = f()/3 + 2*s;
}

```

FUNCTION CALL STATEMENTS:

```
set D[1], <ip> + 5           //replace <ip> with real value!  
set D[1] + 1, D[0]  
set D[1] + 2, fp(<n>)       //replace <n> with real value!  
set 0, D[1]  
set 1, D[1] + <size(AR)>    //replace <size(AR)> with real value  
jump <address>              //replace <address> with real value
```

FUNCTION EXIT STATEMENTS:

```
set 1, D[0]  
set 0, D[D[0] +1]  
jump D[D[1]]
```

INTENTIONALLY LEFT EMPTY TO BE USED FOR EXTRA NOTES

DATA SEGMENT AFTER THE THIRD CALL TO f()

Nr.	Contents	Comments
0)		
1)		
2)		
3)		
4)		
5)		
6)		
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9)		
10)		
11)		
12)		
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SIMPLESEM CODE SEGMENT

Nr.	Code	Comments
0.		Initial current pointer
1.		Initial free pointer
2.		<i>main()</i> :
3.		
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