
Quiz-3 CS618

Duration: 45 Minutes Max Marks: 50

- Write your name and roll number on the question paper and the answer book.
- No explanations will be provided. In case of a doubt, make suitable assumptions and justify.
- There are 2 questions on 2 pages.

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1. (**15 Marks**) Perform **Flow insensitive Subset-based** and **Flow insensitive Equality-based** points-to analysis for each of the programs. Show only the *final* points-to information as points-to graphs.

(a)
```
if(...)
   p = &x;
else
   p = &y;

 x = &a;
 y = &b;
*p = &c;
*y = &a;
```

(b)
```
if(...)
 y = &b;
else
*y = &a;

 p = &x;
 p = &y;
 x = &a;
*p = &c;
```

2. (**35 Marks**) In this problem, you have to perform the steps given below for *Inter-procedural Available Expressions* analysis for the expression `a * b` for the following program. Assume m() is the main function.

```
m() {
    call v()
    call u()
}

u() {
    a * b
    if(...) then
        call v()
    else
        call u()
}

v() {
    if(...) then {
        b = 6
        a * b
    }
}
```

Show the following steps to arrive at the answer:

(a) Draw the inter-procedural flow graph (any one of the two representations discussed in class). Clearly label the nodes, and distinguish the E^0 (intra-procedural) and E^1 (inter-procedural) edges.

(b) For each procedure p, show the constraints for $\phi(r_p, n_p)$ for each node n_p in the CFG of the procedure. Recall that r_p is the entry node for procedure p. Assume the existence of flow functions f_0, f_1, id etc for the underlying data flow framework.

(c) Give the fixed-point solution for $\phi(r_p, n_p)$.

(d) List the program points where the expression `a * b` is available for the program.

[Marks Distribution: 5+15+10+5]