

CS 410 Final Exam

Fall 2001 [Bono]

December 11, 2001

Solution Sheet (4 pages)

Problem 1

1. Common subexpression elimination
2. Copy propagation
3. Constant folding
4. Minimize temp usage
5. Dead code elimination

Problem 2

2, 5, 6, 7, 12

Problem 3

Part A : Access locals and parameters, access current stack frame

Part B : function call OR dispatch

Part C : Save it on the stack

Problem 4

Part A : 2 7 1

Part B : 7 2 0

Part C : 2 1 0 OR 2 5 0 (depends on order of assign "return" values)

Part D : 7 5 0

Problem 5

Part A : 5 1 2

Part B : 2 1 0

Problem 6

(There was a typo in this question. The correct dispatch expression:

```

let x : A <- new B C in
  x.g();
end
)
Part A : A
Part B : dispatch pointer in object X
Part C : C

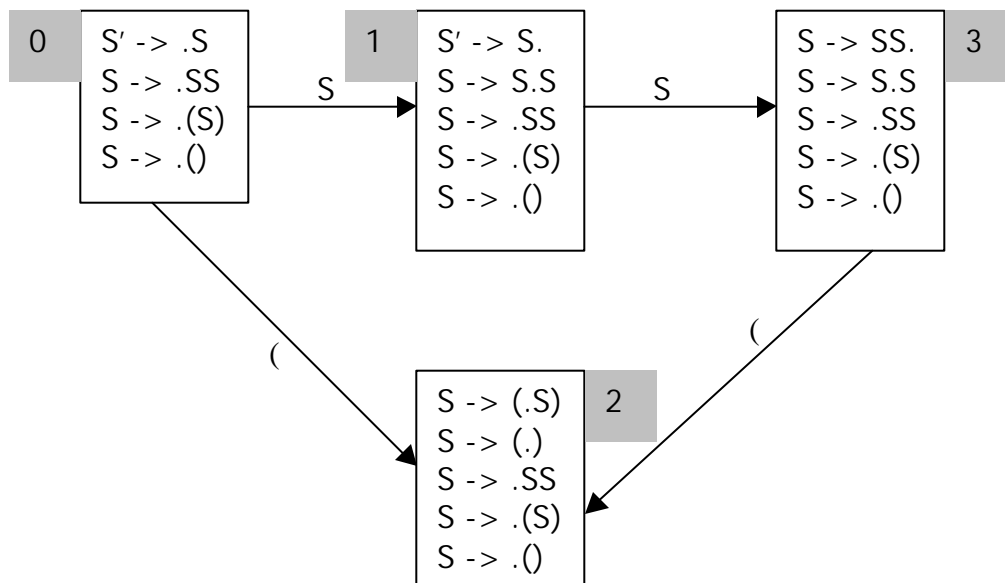
```

Problem 7

- 0) $S' \rightarrow S$
- 1) $S \rightarrow SS$
- 2) $S \rightarrow (S)$
- 3) $S \rightarrow ()$

$FIRST(S) = \{(\}$

$FOLLOW(S) = FIRST(S) \cup \{\$, \}$



Shift-Reduce Error: State 3

Reason: Shift–reduce error on (. Can shift and go to state 2 or reduce by $S \rightarrow SS$ because (is in FOLLOW(S).

Problem 8

Part A

$$(1) t1 = b * c;$$

L	L	L
3	5	-

$$(2) t2 = a / 7;$$

L	D	-
3	-	-

$$(3) t3 = t1 * t2;$$

L	D	D
4	-	-

$$(4) a = t3 / d;$$

L	D	L
-	-	-

$$(5) b = b + 1;$$

L	L	-
-	-	-

Part B

	Liveness	next use
a.	L	2
b.	L	1
c.	L	1
d.	L	4

Problem 9

S -> a S1 a	{S.len = S1.len + 2; }
S -> B	{S.len = B.len; }
B -> ε	{B.len = 0; }
B -> c B1	{B.len = B1.len + 1; }

Problem 10

```
cgen(while e1 loop e2 pool) =
{
    char *loop = newLabel();
    char *after = newLabel();
    cout<<"push 0"<<endl;
    cout<<loop<<":";
    cgen(e1);
    cout<<"if ($a0 = 0) goto " <<after<<endl;
    cgen(e2);
    cout<<"top := top + 1"<<endl;
    cout<<"goto " <<loop<<endl;
    cout<<after<<":";
    cout<<"$a0 = top"<<endl;
    cout<<"pop"<<endl;
}
```