

# 198:515 Programming Languages and Compilers I

## Problem Set 5

**This homework will not be graded. A sample solution will be made available at a later time.**

### Problem 1 - Prolog

Assume the following Prolog program.

```
member(A, [A | B]).  
member(A, [B | C]) :- member(A, C).
```

```
member2(A, [B | C]) :- member(A, C).  
member2(A, [A | B]).
```

Note: A Prolog interpreter is available on the ilab machines. Just say “prolog” on the command line. If you write your program in file “test.pl”, you can load your Prolog program into the interpreter by typing “[test].” at the interpreter prompt.

Show the Prolog search trees for the following queries:

1. `member(a, [a, b, c, a]).`
2. `member(A, [1, 2, 3]).`
3. `member(a, [b, c, X, d]).`
4. `member2(A, [1, 2, 3]).`
5. `member2(a, [X, 2, X]).`

### Problem 2 - Dependence Analysis

Give the direction vectors, and if possible the distance vectors for all dependences in the following loop nests. State explicitly whether a dependence is a true, anti, output, or input dependence.

1. 

```
do i = 3, 100  
  a(i) = a(i-1) + a(i+1) + a(i-2)  
enddo
```
2. 

```
do i = 1, 100  
  a(2*i) = a(2*i-1) + a(2*i+1)  
enddo
```

```
3. do i = 1, 10
    a(i) = a(5) + a(i)
enddo
```

```
4. do i = 1, 10
    a(10-i) = a(5) + a(i)
enddo
```