1 Instructions

1. The homework assignment is to turned in by 11:00 am. in class on April 7.

2. Each question is worth 3 points.

3. Attempt as many problems as you can. You will be given partial credit, as per the policy discussed in class.

2 Problems

1. Consider the following C fragment. Categorize the three assignments as legal or illegal, providing a justification for your answer.

```c
int x, *y, z[3];
(1) &x = (int *)malloc (sizeof(int));
(2) z= (int *)malloc(sizeof(int)*3);
(3) *y = 3;
```

2. Consider the following C declarations:

```c
int x[10];
int y[5];
```

Are x and y type equivalent in C? How is the expression (x == y) handled by the C compiler?

3. Assume that C uses strict type-checking, i.e., there is no type conversion without explicit casting. Further, assume that C has a bool data type. Use the Hindley-Milner type checking algorithm to derive the most general type for the following C function:

```c
fact(n)
{
    if (n == 0)
```
return 1;
else
  return n*fact(n-1);
}

4. Consider a variant of the C language, called C* in which only the do - while loop is specified as part of the syntax. Show how you would capture the semantics of while and for statements, using the do - while construct.

5. (i) Briefly explain the difference(s) between the normal and applicative orders of evaluation.

(ii) Assume that C does not use short-circuiting in using the and operator. Professor Kurtowski attempts to remedy this situation by writing the following function for the and operator:

```c
int and( int a, int b)
{
  return a ? b : 0;
}
```

Will the professor’s technique work, given the semantics of the if-expression in C? Justify your answer.