**Programming Languages (CS 329)**
**Computer Science and Engineering**
**Indian Institute of Technology Bombay**

**Homework 4**
**Out: 2000-10-27**
**Due: 2000-11-10**

1. Prove the following:

$$\frac{P \Rightarrow Q}{\mathrm{wp}(S, P) \Rightarrow \mathrm{wp}(S, Q)} \tag{1}$$

$$\frac{\mathrm{wp}(S, P \vee Q)}{\mathrm{wp}(S, P) \vee \mathrm{wp}(S, Q)} \tag{2}$$

$$\frac{\mathrm{wp}(S, P \wedge Q)}{\mathrm{wp}(S, P) \wedge \mathrm{wp}(S, Q)} \tag{3}$$

2. Use pre/post conditions to show the partial correctness of the following program to find if an input array is a palindrome or not:

```
bool isPalindrome(int a[], int n) {
  bool ans = true;
  int i = 0;
  while ( ans && ( i < n / 2 ) ) {
    if ( a[i] == a[n-1-i] )
      i = i + 1;
    else
      ans = false;
  }
  return ans;
}
```

3. Write in Prolog a program to color a graph using a fixed number of colors such that adjacent nodes have different colors. Exact Prolog syntax is not needed, but you will be better off actually running your program and verifying that it works for small inputs.

4. Given the `class` construct in C++, is the `typedef` construct still required, or is it just a legacy?