CS81 HW#6 Spring 2012 *Out: 02/22/2012. Due: 02/29/2012 (before class)*

Policy on homeworks

1. *Collaboration*: You may discuss a question with any other student currently taking CS81 provided: (i) both of you contribute equally; (ii) you come away from any discussion with an understanding in your mind (and no archived solution of any form is retained); (iii) your submission is your own work prepared by yourself on a separate occassion.

2. *Reference materials*: You should only refer to materials from this semester of CS81 (class notes, handouts, textbooks, grutors, instructor, etc).

3. *Submission*: Your submission should be legible or is prepared using TeX.

Of Tableaux, Sequents and Triples

1. (Peirce's Law) Prove the following assertion using the Analytic Tableaux *and* Sequent Calculus methods.
$$\vdash (((a \to b) \to a) \to a).$$

2. (Prove or Disprove) Consider the following assertion:
$$(\forall x)(\exists y)[A(x) \to B(y)] \vdash (\exists y)(\forall x)[A(x) \to B(y)]$$
If **prove**, provide the proof in the three methods we have studied (Natural Deduction, Analytic Tableaux, and Sequent Calculus). If **disprove**, exhibit a single *model* contradicting the assertion.

3. (Correct or Not Even Wrong) Consider the following program called EXP whose inputs are integers:
```
1:  y = 1
2:  while (b > 0) do
3:      if (b is even) then
4:          a = a * a
5:          b = b/2
6:      else
7:          y = y * a
8:          b = b - 1
9:      end if
10: end while
```
Prove that the following Hoare triple holds:
$$(\!|(a = m) \wedge (b = n) \wedge (m > 0) \wedge (n \geq 0)|\!) \ \text{EXP} \ (\!|y = m^n|\!) \tag{1}$$
State your invariant $\mathcal{I}$ explicitly and use Hoare's logic rules to show (1).