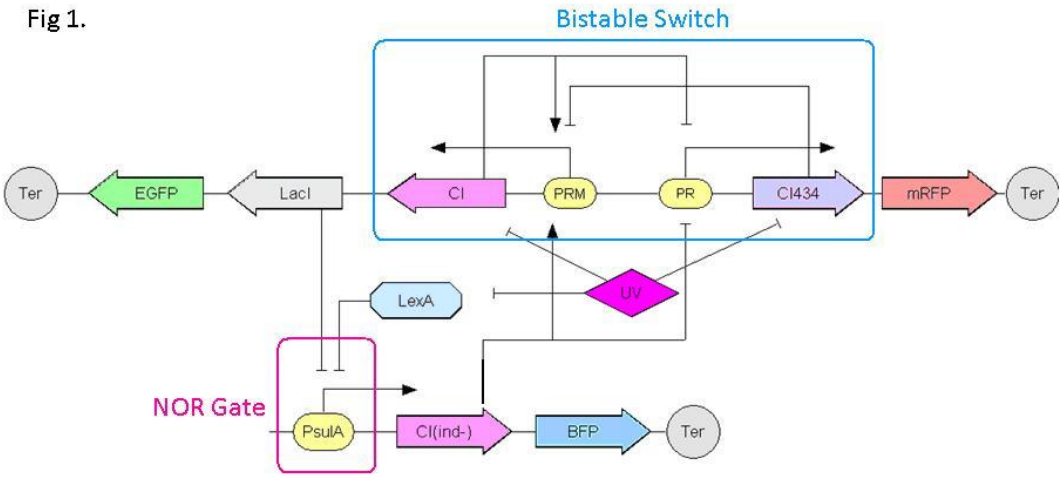
Bioengineering 498A: Systems and Synthetic Biology

February 2, 2009
Homework Assignment #4
Due: 6th February 2009

Points awarded for each question are indicated in square brackets. Return assignment with your name clearly indicated at the top of your answer sheet. [Total points: 100]

[50] **Question 1**. The following network shows the Peking iGEM winning project for 2007:

Fig 1.



This network implements a push-on-push-off switch. That is, press once to turn on, press again to turn it off, and so on. Your task is to deconstruct this network by examining the different components it is made from and understanding its operation on a qualitative level (no simulations necessary).

a) List all the components that make up the circuit. Include promoters, terminators and genes. In the case of the genes, give a brief description of the gene product including any special properties it has which are critical to the network. Describe also the operation of the NOR gate promoter.

b) Explain using a flowchart or similar mode of description, the operation of the circuit as it goes from one state to another. That is, describe how the circuit goes from on to off to on (Assume cI is expressed when in the 'on' state). Two crucial dynamic properties not indicated on the wiring diagram will be needed to understand how this circuit works. One aspect relates to the dynamic response of promoters PRM and PR and the second relates to the dynamic response of LacI.

[50] **Question 2.** Do the same analysis for the Arsenic Biosensor (This is simpler), iGEM 2006 competition.

http://parts2.mit.edu/wiki/index.php/Arsenic_Biosensor

http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04290629

http://www.biomedcentral.com/content/pdf/1752-0509-1-S1-S11.pdf