**6.042 Spring 2016**

**Pset 2 (30pts)**

**Rubric – DRAFT**

**Problem 1 (13pts).**

1. 9pts
   * 1pt for attempting to generalize the given formula to the entire circuit, that is finding a formula which is true whenever the constraints of all the components of the circuit are satisfied.
   * 1 pt for showing that the same formula can be extended to other connectors (such as OR gates)
   * 4 pts for presenting a correct formula that represents the constraints of the entire circuit (AND of all subformulas).
   * 2 pts for the same as above if there is a very minor mistake
   * 2 pts for combining the formula just found with the condition that the output is true
   * 1 pt for concluding that the resulting formula is indeed satisfiable whenever the circuit is.
   * 9pts can be alternatively awarded to any student that presents an alternative proof, as long as it is not only correct in all aspects, but also sufficiently clear and detailed.
   * 7pts for the above if the proof is not very clear.
   * 5pts for the above if there is lack of details. Less points should be awarded if the proof idea is correct but lacks a lot of detail.
2. 3pts
   * 2pts for stating that, given an input circuit, we can efficiently make a formula that is satisfiable whenever the circuit is
   * 1pt for stating that this means that if we can solve SAT efficiently we can also solve Circuit-SAT efficiently
   * -1pt if there is no mention and brief justification of the fact that the process from (a) is efficient or of the fact that the size of FC is proportional to C.

**Problem 2 (6pts).**

1. 3pts

* 3pts if correct answer is given, no reasoning required
* 1pt if correct reasoning (extension of the given example) leads to slightly incorrect formula
* -2 pts if reasoning is given and is incorrect but still got to right answer

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* 3pts if correct answer is given, no reasoning required
* 1pt if correct reasoning (extension of the previous response) leads to slightly incorrect formula
* -2 pts if reasoning is given and is incorrect but still got to right answer

**Problem 3 (4pts).**

(a) 4pts

* 4pts for correct result
* 3pts if result is correct but does not minimize the number of variables whose name has been changed
* 2pts if there is correct reasoning that lead to some minor mistake
* 1pt if the free variables are not handled correctly but x is.

**Problem 4 (7pts).**

* + 1pt for step 1 being done successfully
  + 2pts for turning correctly the implies into NOT, AND, OR connectors
  + 3pts for correct implementation of step 3 (pulling out the quantifiers)
  + 1pt for correctly moving all quantifiers to the beginning (the order must be correct).