Instructions: **We will grade only the work you put on these stapled test sheets in the areas indicated for answers. The blank white paper we will make available is for you to use as scrap paper and will be neither collected nor graded.**

There are six 20-point questions and we will grade all six but will for each student drop the lowest of the six. So it is a 100-point exam. However, we will give each student as extra credit half of the score they got on the dropped question. So it is possible to score a 110/100 (110%) on the exam. (Note: Not all students may have the same ordering of the problems or of the answers, and for example your test paper’s first problem might not be the easiest one.)

There is no partial credit on the parts of this exam: Each multiple-choice answer or TRUE/FALSE answer of course either gets or does not get whatever credit is allocated to it. For example, if a 10-point part of a question has 4 subparts each worth 2.5 points, then the only possible scores on the 10-point part are 0, 2.5, 5, 7.5, and 10. For items where you have to complete (i.e., fill in) some region, there is no partial credit: your answer must be completely correct or you will get no points on that item. Even a missing parenthesis or an “x” when “y” is needed or an “L” when “L” is needed will result in a 0 for that item (even if there is no x or L anywhere in the problem statement or elsewhere in your answer). Please thus check and recheck your answers as it is your responsibility to make sure your answer is completely correct.
This is an in-class midterm exam being given during the April 20 class period. Closed book. Closed notes (except for at most one 8.5-by-11 2-sided—or two 8.5-by-11 1-sided—handwritten self-prepared notes sheets). Write clearly. Closed computer/phones/electronics/etc. (no electronics may even be in sight or reach). You may not leave the room during the exam without irretrievably handing the exam in before leaving.

**No questions may be asked during the exam.** (If you are convinced that something is severely wrong in a way that makes the problem impossible to solve, explain, on your test sheet, what is severely wrong. But for example minor typos where it is clear enough what was intended do not mean you can skip solving a problem.)

So that you have it easily available if you wish, here is a key part of the 2-page template/example document that was linked to from our course’s web home page:

**THE TEMPLATE:**

[We’re trying to prove some particular set, G, is undecidable.]

Our decider for A_TM, assuming that the above set G is decided by decider R, is this machine/program S:

S:

On input <M,w> build the machine M’ that itself, when its input is y, ???[here you have to describe the program of M’, that is, what it does on input y]???

Simulate R(???[the argument to R had better match the syntax/type of the problem we’re attacking!]???)

and ???[here you say what we do, e.g., "if R accepts we accept and if R rejects we reject" or "if R accepts we reject and if R rejects we accept" are the most typical things one would have here]???

End of the program S

???[here goes your explanation of why S is a decider for A_TM. do NOT forget this part of our template. it should have 3 subparts: (1) argue that S is a decider. (2) argue that if <M,w>\in A_TM then S accepts on input <M,w>. (3) argue that if <M,w>\not\in A_TM then S rejects on input <M,w>.]

Note: (2) and (3) actually basically give (1), give or take the issue of syntactically illegal inputs to M’. But still, just as an automatic thing, do include (1), (2), and (3).]???