

1 YOUR NAME/ID/SEAT: ((Personalized name/ID/seat will be here)) .
 2 **You must copy and sign this** (you are allowed to copy and sign this before the exam): “I affirm that I will
 3 not give or receive any unauthorized help on this exam, and that all work will be my own.” _____

4 _____
 5 _____ Signature _____

6 **Completely optional and not at all tied to how your exam will be graded**, but so that I know
 7 who *might* be interested in this among those eligible for this employment opportunity: I have funding for Fall
 8 2023 and Spring 2024 to employ some students to do research under my “Complexity and Computational
 9 Social Choice” project, as I have a supplement to that core research grant to support an NSF (it is a large US
 10 government agency that supports science) “REU” (Research Experiences for Undergraduates). **If (a) you**
 11 **meet the NSF’s *citizenship condition*** on its REU money (the NSF only allows the money to be paid to
 12 US citizens, US nationals (that term applies for example to people born in certain US territories such as, e.g.,
 13 American Samoa), and US permanent residents; and my apologies—that is the NSF’s strict rule, not mine),
 14 **and (b) you’ll be a *full-time undergraduate* at UR in Fall 2023, and (c) you might possibly be**
 15 **interested learning about what the REU involves and possibly working on it if I were to offer**
 16 **you employment, then please put a check-mark in the box just before this. Checking the box**
 17 **in no way commits you if I invite you.** (Notes: The people I employ will likely be employed for up to
 18 14 hours a week; though people get paid only for actual hours worked, and in some weeks of course might
 19 work less, e.g., if busy during midterm exam week. I’d explain in more detail all about the REU to anyone I
 20 invite. The REU students I’ve employed so far much enjoyed the REU I believe, and each published at least
 21 one technical report, and in many cases conference papers also.)

22 Midterm 2 2023/4/19
 23 CSC 280/480: Computer Models and Limitations, Prof. Lane Hemaspaandra, Spring 2023

	Problem	Score
<input type="checkbox"/> <input type="checkbox"/>	(Part 1) 1	
<input type="checkbox"/> <input type="checkbox"/>	(Part 1) 2	
<input type="checkbox"/> <input type="checkbox"/>	(Part 1) 3	
<input type="checkbox"/> <input type="checkbox"/>	(Part 1) 4	
<input type="checkbox"/> <input type="checkbox"/>	(Part 1) 5	
<input type="checkbox"/> <input type="checkbox"/>	(Part 1) 6	
<input type="checkbox"/> <input type="checkbox"/>	Part 1 Total (= sum of the five highest of 1/2/3/4/5/6)	
<input type="checkbox"/> <input type="checkbox"/>	Extra Credit: 1/4 of your score on the dropped question from Part 1	
<input type="checkbox"/> <input type="checkbox"/>	Extra Credit: Part 2	
<input type="checkbox"/> <input type="checkbox"/>	Total (i.e., Your Exam Score)	/100

26 **Instructions: We will grade only the answers you put on these stapled test sheets in the areas**
 27 **indicated for answers. The blank white paper we will make available is for you to use as scrap**
 28 **paper and will be neither collected nor graded.**
 29 There are six 20-point questions in Part 1 and we will grade all six but will for each student **drop the**
 30 **lowest of the six.** So it is a 100-point exam. However, we will give each student as extra credit *one fourth*

1 of the score they got on the dropped question plus any points they got in the (extra credit) 7-point Part 2 of
2 the exam. So it is possible to score a 112/100 (112%) on the exam. (Note: Not all students may have the
3 same ordering of the problems or of the answers, and, for example, your test paper's first problem might not
4 be the easiest one.)

5 There is no partial credit on Part 1 of this exam. For example, each multiple-choice answer (if we have
6 any such problems¹) of course either gets or does not get whatever credit is allocated to it. For example,
7 if a 20-point question has 5 subparts each worth 4 points, then the only possible scores on the question are
8 0, 4, 8, 12, 16, and 20. For items (if we have any such problems) where you have to complete (i.e., fill in)
9 some region, there is no partial credit: your answer must be completely correct or you will get no points
10 on that item; even a missing parenthesis or an "x" when "y" is needed or an "L" when "L'" is needed will
11 result in a 0 for that item (even if there is no x or L anywhere in the problem statement or elsewhere in your
12 answer). Please thus check and recheck all answers as it is your responsibility to make sure your answer is
13 completely correct. Part 2 of this exam may be a slight exception to the no partial credit rule, but even on
14 that part, an answer will get no points unless it is basically perfect except perhaps for some utterly trivial
15 thing such as a missing parenthesis that in the grader's judgment in no way makes the answer wrong or
16 unclear or ambiguous.

17 This is an in-class midterm exam being given during the April 19 class period. Closed book. Closed
18 notes (except for at most one 8.5-by-11 2-sided—or two 8.5-by-11 1-sided—*handwritten* self-prepared notes
19 sheets). **Write clearly.** Closed computer/phones/electronics/etc. (no electronics may even be in sight or
20 reach). **You may not leave the room during the exam** without irretrievably handing the exam in
21 before leaving.

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

26 =====

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

29 THE TEMPLATE:

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

31 Our decider for A_TM, assuming that the above set G is decided

32 by decider R, is this machine/program S:

33 S:

34 On input <M,w> build the machine M' that itself, when its input is y,

35 ???[here you have to describe the program of M', that is, what it does

36 on input y]???

37 Simulate R(???[the argument to R had better match the syntax/type

38 of the problem we're attacking!]???), and ???[here you say what

39 we do, e.g., "if R accepts we accept and if R rejects we reject"

40 or "if R accepts we reject and if R rejects we accept" are the

41 most typical things one would have here]???

42 End of the program S

43 ???[here goes your explanation of why S is a decider for A_TM. do

44 NOT forget this part of our template. it should have 3 subparts:

45 (1) argue that S is a decider.

46 (2) argue that if <M,w>\in A_TM then S accepts on input <M,w>.

47 (3) argue that if <M,w>\not\in A_TM then S rejects on input <M,w>.

48 NOTE: (2) and (3) actually basically give (1), give or take the issue

49 of syntactically illegal inputs to M'. But still, just as an

50 automatic thing, do include (1), (2), and (3).]???

¹I am using that oblique phrasing here and elsewhere in the instructions as these instructions will be made available before the exam happens.