

ICS 6B F23 Take Home Exam 6

Due: November 10th, 2023 at 11:59PM

Name: _____

UCI NetID :

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(alpha-numeric; NOT your student ID)

- Read the instructions of each question carefully.
- All problems will have a "What to show" section that will describe exactly what work is expected of you we solving the problem. Failure to meet the requirements of the "What to show" sections will result in a Not Yet. If you have questions about what to show please ask on Ed.
- An answer where thought process is unclear will be given a grade of Not Yet
- Your submission should follow the template exactly. Any insertion, removal, or reordering of pages from the original template may result in readers not grading certain problems. In such an event you will receive "Not Yet" and no feedback on the problems in question.
- Place your answers in the boxed regions. Writing outside of the boxes will not be considered as part of your answers.
- This exam will cover the Outcomes from the B Learning Objective
- Please keep in mind of the academic honesty guidelines. This take-home exam is to be **completed individually, with no outside help**. You may use any resources from our class (ZyBooks and resources from Canvas), but you may not use any other online resources.
- You may choose to print the exam or use a digital editor for completing the exam. It is required that you use this PDF to complete your work. If you have no access to a printer or digital tools to fulfill the exam, feel free to reach out to the staffs regarding your concern.
- If you have any questions, please post a private Ed or attend available Office Hours. Note that we are not allowed to provide specific help to answering the exam questions.

Problem 1.1 (B1)

x	y	z	$f(x, y, z)$
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Produce an expression that is a sum of minterms for $f(x, y, z)$.

What you need to show: Writing down the answer is sufficient. No need to explain.

Problem 1.2 (B1)

$g(a, b, c) = (\bar{a} + b + c)(a + \bar{b} + c)(a + b + \bar{c})$. Create an input/output table for $g(a, b, c)$.

What you need to show: Writing down the answer is sufficient. No need to explain.

Problem 2.1 (B2)

Identify whether the following functions are in DNF, CNF, both, or neither.

- (a) $\bar{x}yzw$
- (b) $xyz + x\bar{y}\bar{z}w + yz\bar{w}$
- (c) $(x + \bar{y} + z)(x + \bar{z} + \bar{w})w$
- (d) $(xyw + \bar{z})(x + \bar{y})$

What you need to show: For each of the four parts, choosing the answer is sufficient. No need to explain.

Problem 2.2 (B2)

- a) Convert the following Boolean expression $(ab + \bar{b}c)\overline{(de + \bar{h})}$ into DNF.
- b) Convert the following DNF expression $a\bar{c}e + ade + \bar{b}\bar{c}e + \bar{b}de$ into CNF using the laws of Boolean Algebra.

What you need to show: For part a), you don't need to write out the full table if you try to do the conversion by writing out the input/output table of the expression, just write out the rows that are relevant to the minterms in the final expression. Label each step with the law of Boolean Algebra used to establish that step if you do the conversion by the laws. Put the final expression in the designated box.

For part b), label each step with the law of Boolean Algebra used to establish that step, starting with the "original expression". Put the final expression in the designated box.

Problem 4 (B4)

Assume in a research team there are 4 team members: A, B, C, D (these are the initials of their first names). There are 4 different types of tasks for them to complete: E (experimental work), T (theory work), S (simulation work), W (writing papers).

We will use two letter variables, where the first letter is the letter of the team member doing the task and the second letter corresponds to the type of task it is. For example, the variable AE having a value of 1 means that A is doing experimental work while AE having a value 0 means that A is not doing experimental work. Provide a Boolean expression to describe the satisfiability of each of the following situations.

- A is doing experimental work and not doing theory work, C is doing theory or simulation work (or both), and D is doing theory work and writing papers. (Don't assume anything about whether someone is doing some task or not if it's not mentioned; for example, don't assume anything about whether A is doing simulation work or not.)
- B is good at the three types of tasks: experimental work, theory work and simulation work. But B is only working on exactly one of the three listed types. (Don't assume anything about whether B is writing papers or not.)

What you need to show: For each part, writing down the answer is sufficient. No need to explain.

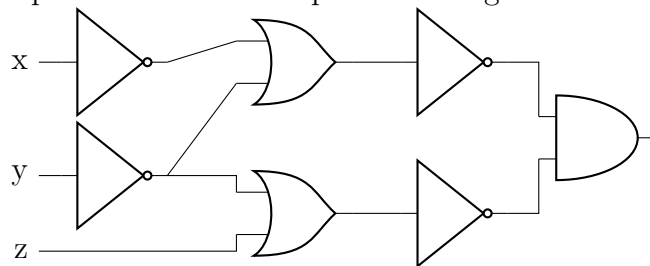
Problem 5.1 (B5)

The output of $f(x, y)$ is 1 if and only if the value of $x = x \uparrow y$. Write the input/output table for $f(x, y)$ first and construct a circuit to implement $f(x, y)$ based on the table. The number of gates in the circuit should be as less as possible.

What you need to show: Writing down the table and drawing the circuit are sufficient. No need to explain.

Problem 5.2 (B5)

Provide the Boolean expression that represents the circuit below. Simplify the Boolean expression as much as possible using the laws of Boolean Algebra.



What you need to show: Place the original expression in the designated box. Label each step in the table with the relevant Boolean Algebra law used for that step, starting with the "original expression."