

Math Homework 10

CS540

July 26, 2019

1 Instruction

Please submit your answers on Canvas → Assignments → M10. Late submission will not be accepted.

Please add a file named "comments.txt", and in the first line of the file, grade yourself: 1, 1.5, 2 (for the entire homework, not for individual questions). In your submission, please do not write your name if you do not want other students to see it (in the case it is posted as a sample solution).

Grade	Meaning
1	You attempted something but mostly incorrect.
1.5	You attempted something but there are mistakes.
2	You have the correct answers + permission to post as a sample solution.

You can put 2.5 if you already got 2 in the Quizzes for the week.

2 Questions

2.1 Question 1

Find the truth assignments for A, B, C, D, E that satisfies all the following clauses. All but one of the variables is true.

- $A \vee \neg B \vee C$
- $\neg A \vee C \vee D$
- $B \vee D \vee \neg E$
- $\neg C \vee \neg D \vee \neg E$
- $\neg A \vee \neg C \vee E$

2.2 Question 2

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Which ones of the following states have the highest reproduction probability? The fitness function is $5a + 3bc - d + 2e$.

$$(a, b, c, d, e) =$$

- $(1, 1, 0, 1, 1)$
- $(0, 1, 1, 0, 1)$
- $(1, 1, 0, 0, 0)$
- $(1, 0, 1, 1, 1)$
- $(1, 0, 0, 0, 0)$

2.3 Question 3

There are N lions. Each lion i can choose to jump out and eat the slightly smaller lion $i - 1$, or stay hidden, and only lion 1 can eat the bunny. In particular, lion 3 can only eat lion 2, but not lion 1 or the bunny. Each lion prefers eating (alive) to staying hungry (alive) to being eaten. Show that the bunny will be eaten if and only if N is odd.

2.4 Question 4

5 pirates got 100 gold coins. Each pirate takes a turn to propose how to divide the coins, and all pirates who are still alive will vote whether to accept the proposal or reject the proposal, kill the pirate, and continue to the next round. Use strict majority rule for the vote, and use the assumption that if a pirate is indifferent, he or she will vote reject with probability 50 percent. Show that the first pirate will propose $(97, 0, 1, 0, 2)$.

2.5 Question 5

An applicant can produce 20 dollars worth of products per hour. Two profit-maximizing companies compete to hire the applicant. Company 1 makes an offer first, then company 2 sees the offer and makes another offer. The applicant goes to the company that offers a higher wage, and in case of a tie, he or she will flip a fair coin to decide. What should the offers be (hourly wage, only integer amounts allowed)?

Hint: both $(19, 19)$ and $(18, 18)$ are solutions.