

## Discretionary Note

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**IF YOU USE THIS FILE TO CHEAT, YOU ARE NOT ONLY STUPID BUT YOU ARE CHEATING YOURSELF OUT OF THE ABILITY TO FALL IN LOVE WITH MATH.** Furthermore, I am not smarter than you and my solutions did not always get a perfect score.

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# Math 244 - Problem Set 3

due Monday, February 10, 2025, at 11:59pm

## Section 2.3

1. How many linear extensions of  $\mathcal{B}_2$  are there, and what about  $\mathcal{B}_3$ ?
5. (optional bonus problem) ~~Prove that not every finite poset admits an embedding into the ordered set of triples of real numbers as in Example 2.1.1.~~ *Note from Prof. Hall: This problem as stated seems to be unnecessarily difficult, so we are replacing it with a simpler problem:* Prove that not every finite poset admits an embedding into the poset  $(\mathbb{N}^2, \preceq)$ , where  $(x_1, y_1) \preceq (x_2, y_2)$  if and only if  $x_1 \leq x_2$  and  $y_1 \leq y_2$ .

## Section 2.4

3. Find a sequence of real numbers of length 16 that contains no monotone subsequence of length 5. *Note from Prof. Hall: The version in the textbook has “17” instead of “16”, but this is a typo.*
4. Prove the following strengthening of Theorem 2.4.6: Let  $k, \ell$  be natural numbers. Then every sequence of real numbers of length  $k\ell + 1$  contains a nondecreasing subsequence of length  $k + 1$  or a decreasing subsequence of length  $\ell + 1$ .

## Section 3.1

2. Determine the number of ordered pairs  $(A, B)$ , where  $A \subseteq B \subseteq \{1, 2, \dots, n\}$ .
6. Show that a natural number  $n \geq 1$  has an odd number of divisors (including 1 and itself) if and only if  $\sqrt{n}$  is an integer. *The textbook has a hint to this problem in the back.*