

MATH 3094 HW 2 PERMUTATIONS COMPUTATION (HANDWRITTEN WORK IS OK)

YOUR PREFERRED FIRST AND LAST NAME

Credit: Write down everyone who helped you, including classmates who contributed to your thought process (either through sharing insights or through being a sounding board). Write down Judson's textbook and other written sources you used as well.

Instruction. Please remove this instruction section when you are done.

You can complete this homework by hand or L^AT_EX. Either submit a physical copy (in class) or upload a PDF (if handwritten) or your Overleaf link on HuskyCT. If you don't have access to the course HuskyCT, please create a private post and upload your PDF/Overleaf link on Piazza (instruction for attaching a PDF: <http://support.piazza.com/customer/portal/articles/1646680-attach-a-file-to-a-post>)

Exercises. No proofs are necessary. From Judson Chapter 5 Exercises <http://abstract.ups.edu/aata/exercises-permute.html>, please complete ...

- i) Exercise 1a,b.
- ii) Compute Exercise 2f,g,i,j,n,o,p by hand. Then confirm your answers with SageMath. SageMath Hints:
 - (a) To compute the inverse of a permutation assigned to a variable called `sigma` using SageMath, type `sigma.inverse()`.
 - (b) To check whether two permutations called `sigma` and `theta` are equal, type `sigma == theta`.
- iii) Exercise 3b,d.
- iv) Exercise 4. Find the inverse of $(a_1, a_2, a_3, \dots, a_n)$.
- v) **Definition:** The *order* of a permutation is the smallest positive integer m such that $a^m = id$. For example, the order of $(1, 2)(3, 4)$ is 2, and so is the order of $(1, 2)$. The order of $(1, 2, 3, 4)$ is 4, and the order of $(1, 2)(3, 4)(5, 6, 7)$ is 6. The order of the identity permutation is 1.

Exercise 8. Find a permutation in A_{10} with order 15. Write this permutation as a product of transpositions. Click here for a hint. Then confirm this using SageMath. SageMath Hint: To

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compute the order of a permutation σ using SageMath, type `sigma.order()`.

- vi) Exercise 9. *Can you* find a permutation in A_8 with order 26?
- vii) Exercise 13. Let $\sigma = \sigma_1\sigma_2\ldots\sigma_m \in S_n$ be the product of disjoint cycles. What is the order of σ ?
- viii) Exercise 15. This exercise would be much easier/more fun if you make a 3-dimensional paper cube and label the vertices! If the diagonals of a cube are labeled as Figure 1, to which motions of the cube do the following permutations correspond?
 - a. (12)
 - b. $(12)(34)$
 - c. (123)
 - d. (1234)

Explain the motion in words or with pictures. If you want to include a PDF picture on LaTeX, follow my source code for Figure 1.
- ix) Approximately how much time did you spend on this homework?

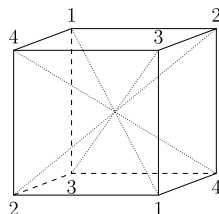


FIGURE 1. A cube