Ma2201/CS2022 Quiz 0010

## Discrete Mathematics D Term, 2019

Print Name: Sign:

1. (6 points) a) How many anagrams of *MISSISSIPPI* are there? b) How many anagrams of MISSISSIPPI have no double P's (two consecutive P's).

 $\clubsuit$  a) The string  $MI_1S_1S_2I_2S_3S_4I_3P_1P_2I_4$  of 11 distinct letters has 11! anagrams. To organize the over-counts, each anagram has  $4! \cdot 4! \cdot 2!$  ways of reordering the S's, the I's and the P's. giving the same anagram when the subscripts are removed. So there are

$$\frac{11!}{4! \cdot 4! \cdot 2!}$$

anagrams.

b) We count the ones with double P's, and subtract from the total for part 1. Just regard PP as a single letter, then you have by the argument above:

> 10! $4! \cdot 4!$

anagrams of MISSISSI(PP)I, so we have

$$\frac{11!}{4! \cdot 4! \cdot 2!} - \frac{10!}{4! \cdot 4!}$$

\*

anagrams with no double P's.

2. (4 points) Find the binary representations of both the decimal numbers 2018 and 2022 in base 2 and in base 16.

Show all your work.

 $\clubsuit$  Dividing by 2 and taking remainders:

$$2018 = 2 \cdot 1009 + 0$$

$$1009 = 2 \cdot 504 + 1$$

$$504 = 2 \cdot 252 + 0$$

$$252 = 2 \cdot 126 + 0$$

$$126 = 2 \cdot 63 + 0$$

$$63 = 2 \cdot 31 + 1$$

$$31 = 2 \cdot 15 + 1$$

$$15 = 2 \cdot 7 + 1$$

$$7 = 2 \cdot 3 + 1$$

$$3 = 2 \cdot 1 + 1$$

$$1 = 2 \cdot 0 + 1$$

So  $11111100010_2$ , or  $111, 1110, 0010_2$ . And you would be crazy to start over again for 2022, which is 2018 + 4.

Just add four in binary:  $100_2$  so  $111, 1110, 0110_2$ .

Then to convert that to base 16, again, we don't have to start over, just find 111, 1110, 0010 and 0110 in base 16, respectively, 7, E, 2 and 6, so  $7E2_{16}$  and  $7E6_{16}$ . ÷

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