MA2201/CS2022
Quiz 0010

Discrete Mathematics

D Term, 2018

PRINT NAME: ____________________

$\mathcal{SIGN}$: ____________________

1. (2pts) Convert 1984 to binary.

Solution

Dividing by 2:

number	1984	992	496	248	124	62	31	15	7	3	1
quotient	992	496	248	124	62	31	15	7	3	1	0
remainder	0	0	0	0	0	0	1	1	1	1	1

we get 11111000000.

2. (3pts) How many anagrams of $POLYTECHNIC$ have the letters of $YELP$ occurring in that order, such as $\underline{Y}CC\underline{E}HTIN\underline{L}O\underline{P}$

Solution

There are 11! anagrams if we distinguish the C's, so 11!/2 anagrams. In this set of 11!/2 strings, for each of the type we are looking for, there are 4! with the letters in $YELP$ variously arranged, and we want exactly one of those, so

$$(11!/2!)/4! = 11!/(2!4!)$$

3. (2pts) How many anagrams of $POLYTECHNIC$ the letters of $YELP$ in that order, and together in sequence, such as $CONCH\underline{YELP}IT$

Solution

The easiest thing to do is to regard $YELP$ as one big ugly letter. So there are eight letters to be rearranged, and two identical C's as before, so 8!/2!.

Alternatively, you can place the Y first amongst the first 8 positions, 8 choices, and then the remaining seven positions are to be filled with the remaining 7 letters in order, 7!, and again dividing out because of the duplicate C's. (8)(7!)/2, which is the same as before.

4. (3pts) Mark each of the following TRUE or FALSE

___ $a \in \mathcal{P}(\{a, b, c\})$

___ $a \subseteq \{a, b, c\}$

___ $\{\emptyset\} \subseteq \mathcal{P}(\{a, b, c\})$

Solution

First is FALSE - $\{a\} \in \mathcal{P}(\{a, b, c\})$, not a.

Second is FALSE - $\{a\} \subseteq \{a, b, c\}$, not a.

Third is TRUE - For $A \subseteq B$, every element of A must be an element of B. $\{\emptyset\}$ has exactly one element, $\emptyset$, which we would have to have as an element of $\mathcal{P}(\{a, b, c\})$. The elements of $\mathcal{P}(\{a, b, c\})$ are the subsets of $\{a, b, c\}$, so since $\emptyset \subseteq \{a, b, c\}$, it is true that $\emptyset \in \mathcal{P}(\{a, b, c\})$.