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Welcome Back...

...to the second edition of the 2020 RoM! Students and staff alike had an exciting second week at MathILy; each new day at *root class* brought rise to new topics, conjectures, and discussions from students. Next, a deep dive into this week's *DaILy Gathers* and *Life Seminar* (with another guest appearance of the National Film Board of Canada, of course!). And finally, make sure to check out this week's *Fun section*, featuring wacky quotes, a rant on soap and some other...questionable articles.

Weekly Cutie!

The National Film Board of Canada, with a logo that is somehow just as creepy yet strangely adorable as their animations.

Contents

2.3.7 Rabbit Probabilities

Brian has a collection of n rabbits and n rings, each owned by a unique rabbit. If he summons $2k$ hats to cover any of his $2n$ rabbits and rings, how many rabbit-ring pairs do we expect to be covered by the hats? We answered this question and more with definitions of probability and expected value.

2.3.8 Analments, Images, and Even More Matrices

Knowing that we can write a linear map as a matrix: $f(\vec{v}) = M\vec{v}$, we expressed injectivity and surjectivity conditions of f with properties of M. We then defined an Analment, $An(M)$ as the set of solutions to equation $Mv = 0$, and an image $Im(A) = A\vec{v}$. We developed the "Andy is Right"/"dimsum" theorem, which said the $dim(An(M)) + dim(Im(A)) = dim(domain(M))$, where $dim(A)$ is the dimension of A. We also showed that function composition $g(f(e))$ can be described with a matrix that is the product of the matrices describing $f(e)$ and $g(e)$, and proved associativity of matrix multiplication.

2.3.9 BunBun's Rabbit Holetel: Elmer Fudd NOT WELCOME

In the rabbits' plan for global domination, the rabbits they created BunBun's Rabbit Holetel, an underground bunker with infinitely many rooms. We discussed how BunBun's Rabbit Holetel would be able to accommodate for (in)finitely many new rabbits. When the Holetel was renovated to install WiFi, we dshowed that the rabbits can fill the infinitely many bunkers under each of their infinitely many rooms. We then defined the function $Club(N)$, which would denote the set of all possible clubs (subsets) of N rabbits. Unfortunately, we concluded there were not enough rooms for all of our clubs.

2.3.10 I like PIE

After trying to count things in very very formal manners, we devised a method of counting the number of elements in the union of a bunch of sets; we referred to this method as PIE. We then applied PIE to count the number of 10 letter words without all the vowels, which came out to be 140,948,727,708,936 (coincidentally, the same number of hats in Brian's possession).

2.3.11 Rabbit INvasion and DOMINIONS

The rabbits have finally invaded the realm! However, the realms are protected by staffs, which create magical barriers, which section of dominions of the realm map. The rabbits have populated the outer dominion and they can use their jazzy gem rings to destroy the magical barriers. We concluded that the least number of jazzy gem rings necessary was equal to the number of inner dominions. We also found a relationship between the number of staffs (S), barriers (B), and inner dominions (D): $D = B - S + 1$.

2.3.12 Nadavs (and more Arrowverses)

We first encountered Nadavs when considering whether two incantations are "the same". We eventually defined that two incantations I_1, I_2 are "the same" (or Nadav) if we have a bijective function $f : I_1 \to I_2$ (also called Nadav). We then defined Nadav for skeins as well as arrowverses. Later, we showed that a Nadav for an arrowverse was simply a bijective linear map. We also showed that Nadavness is transitive. We then related Nadavs to arrowverses by defining the dimension of an arrowverse to be the n if that arrowverse is Nadav to $\mathbb{R}^n$, and n is also the number of objects in the foundation of that arrowverse. Later,