[TAOCP 5 8.9.10.11]
A Sample TEX SIGma Presentation

Ma, Sig

Outline

Updates!

Weekly updates:

- SIGma is an excellent SIG.
- I'm out of ideas for updates.

Section 1

Basics

Some Text

- You may want some stuff to appear in a sequence

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- Use \pause for this

Some Text

- You may want some stuff to appear in a sequence
- Use \pause for this
- colors are cool

Some Math Mode Testing

$$\frac{x^2+3}{y^2+7}$$

$$\mathcal{L}_{\mathcal{T}}(\vec{\lambda}) = \sum_{(\mathbf{x},\mathbf{s})\in\mathcal{T}} \log P(\mathbf{s} \mid \mathbf{x}) - \sum_{i=1}^{m} \frac{\lambda_i^2}{2\sigma^2}$$

$$\int_0^8 f(x)dx$$

There Is No Largest Prime Number

The proof uses *reductio ad absurdum*.

Theorem

There is no largest prime number.

Proof

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2. Let q be the product of the first p primes

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3. Then $q + 1$ is not divisible by any of them

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1. Suppose p were the largest prime number
2. Let q be the product of the first p primes
3. Then $q + 1$ is not divisible by any of them
4. But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers.

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The proof uses *reductio ad absurdum*.

Theorem

There is no largest prime number.

Proof

1. Suppose p were the largest prime number
2. Let q be the product of the first p primes
3. Then $q + 1$ is not divisible by any of them
4. But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers.
5. Thus, there exists a prime larger than p.

Sequential Math Frames

Here is a sentence

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I shall now carry out some calculations

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$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}$$

Sequential Math Frames

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$$
\begin{aligned}
\zeta(s) &= \sum_{n=1}^{\infty} \frac{1}{n^s} \\
&= \prod_{p \in \text{primes}} \frac{1}{1 - p^{-s}} \\
&= \frac{1}{1 - 2^-s} \cdot \frac{1}{1 - 3^-s} \cdots
\end{aligned}
$$

Sequential Math Frames

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&= \frac{1}{1 - 2^{-}s} \cdot \frac{1}{1 - 3^{-}s} \cdots \\
&= \frac{1}{\Gamma(s)} \int_0^{\infty} \frac{x^{s-1}}{e^x - 1} \, \mathrm{d}x
\end{aligned}
$$

Section 2

Some Template Slides

Subsection 1

A subsection, Wow

Image

$$\Sigma$$

Side by Side

$$\Sigma \qquad\qquad \Sigma$$

Demonstration of algo and nalgo env

```
GetRandomNumber():
    return 4        ⟪ chosen by fair dice roll. ⟫
                    ⟪ guaranteed to be random. ⟫
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Random number generation from [Mun07]. **⟨⟨ \cref for line numbers does not work. If you want to refer to specific line numbers, do it manually ⟩⟩**

$\underline{\textsc{AlgorithmP}(S[a_0, \ldots, a_n])}$:

```
C[1..n] ← 0, O[1..n] ← 1
while TRUE:
    PRINT(S)
    j ← n, s ← 0
    A:  q ← C[j] + O[j]
        if q < 0: goto D
        if q = j: goto B
        SWAP(S, j − C[j] + s, j − q + s)
        C[j] ← q
        continue
    B:  if j = 1:
            break
        s ← s + 1
    D:  O[j] ← −O[j], j ← j − 1
        goto A
```

- Here is an example of annotating an algorithms

```
AlgorithmP(S[a_0, ..., a_n]):
C[1..n] ← 0, O[1..n] ← 1
while True:
    print(S)
    j ← n, s ← 0
    A: q ← C[j] + O[j]
        if q < 0: goto D
        if q = j: goto B
        swap(S, j − C[j] + s, j − q + s)
        C[j] ← q
        continue
    B: if j = 1:
            break
        s ← s + 1
    D: O[j] ← −O[j], j ← j − 1
        goto A
```

- Here is an example of annotating an algorithms
- We have grayed out text to highlight what we want to discuss

Source Code

```python
def algorithm_g(n):
    a = [0 for _ in range(n + 1)]
    while True:
        curr = a[1 : n + 1][::-1]
        yield "".join([str(i) for i in curr])

        a[0] = 1 - a[0]
        j = 1
        while a[j - 1] != 1:
            j += 1
        if j == n + 1:
            return
        a[j] = 1 - a[j]
```

Theorems and Lemmas

Lemma

The map $\mathbb{C} \times (\mathbb{C} \setminus \{ 0 \}) \to \mathbb{C}$, $(z, w) \mapsto z/w$ is C^∞.

Proof

To see this, we identify $\mathbb{C}$ with $\mathbb{R}^2$ where $a + bi = (a, b)$. Thus our map is now

$$\begin{aligned} \left(\mathbb{R}^2\right) \times \left(\mathbb{R}^2 \setminus \{ (0,0) \}\right) &\to \mathbb{R}^2 \\ ((a,b),(c,d)) &\mapsto \left(\frac{ac+bd}{c^2+d^2}, \frac{bc-ad}{c^2+d^2} \right) \end{aligned}$$

which is well defined since at least one of c or d is nonzero. It is simple to verify that this map is equivalent to the original one. Since this new map is C^∞ in each component, we have that it is C^∞ overall.

Section 3

Conclusion

Questions?

Questions!

- How many zeros of $\zeta(s) = \sum_{i=1}^{\infty} \frac{1}{n^s} = \prod_{p \text{ prime}} \frac{1}{1-p^{-s}}$ have real part equal to $\frac{1}{2}$?
- Find a closed form to the following recurrence:

$$f(n) = \begin{cases} f\left(\frac{n}{2}\right) & n \text{ even} \\ f3n+1 & \text{otherwise} \end{cases}$$

So long and thanks for all the fish!

— DOUGLAS ADAMS (1979)

Bibliography

Randall Munroe.

Rfc 1149.5 specifies 4 as the standard ieee-vetted random number.

https://xkcd.com/221/, 2007.

Accessed: 01-09-2023.