

[TAOCP 5 8.9.10.11]

A Sample T_EX SIGma Presentation

Ma, Sig

Outline

Basics

Some Template Slides

A subsection, Wow

Conclusion

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

Some Text

- You may want some stuff to appear in a sequence
- 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

1. Suppose p were the largest prime number

There Is No Largest Prime Number

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

There Is No Largest Prime Number

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

There Is No Largest Prime Number

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.

There Is No Largest Prime Number

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

Sequential Math Frames

Here is a sentence

I shall now carry out some calculations

Sequential Math Frames

Here is a sentence

I shall now carry out some calculations

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

Sequential Math Frames

Here is a sentence

I shall now carry out some calculations

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

Sequential Math Frames

Here is a sentence

I shall now carry out some calculations

$$\begin{aligned}\zeta(s) &= \sum_{n=1}^{\infty} \frac{1}{n^s} \\ &= \prod_{p \in \text{primes}} \frac{1}{1 - p^{-s}} \\ &= \frac{1}{1 - 2^{-s}} \cdot \frac{1}{1 - 3^{-s}} \cdots \\ &= \frac{1}{\Gamma(s)} \int_0^{\infty} \frac{x^{s-1}}{e^x - 1} \, dx\end{aligned}$$

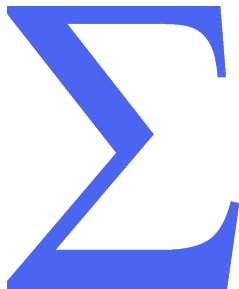
Section 2

Some Template Slides

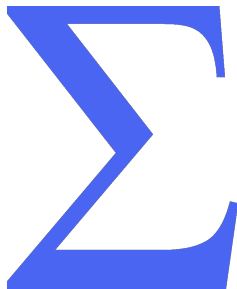
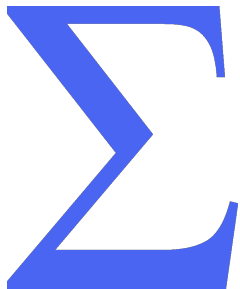
Subsection 1

A subsection, Wow

Image



Side by Side



Demonstration of algo and nalgo env

GETRANDOMNUMBER():

return 4 *⟨⟨ chosen by fair dice roll. ⟩⟩*
 ⟨⟨ guaranteed to be random. ⟩⟩

GETRANDOMNUMBER():

1: return 4 *⟨⟨ chosen by fair dice roll. ⟩⟩*
2: *⟨⟨ guaranteed to be random. ⟩⟩*

Random number generation from [Mun07]. *⟨⟨ \cref for line numbers does not work. If you want to refer to specific line numbers, do it manually ⟩⟩*

ALGORITHM P($S[a_0, \dots, a_n]$):

```
1:  $C[1..n] \leftarrow 0, O[1..n] \leftarrow 1$ 
2: while TRUE:
3:   PRINT( $S$ )
4:    $j \leftarrow n, s \leftarrow 0$ 
5:   A:  $q \leftarrow C[j] + O[j]$ 
6:       if  $q < 0$ : goto D
7:       if  $q = j$ : goto B
8:       SWAP( $S, j - C[j] + s, j - q + s$ )
9:        $C[j] \leftarrow q$ 
10:      continue
11:   B: if  $j = 1$ :
12:       break
13:        $s \leftarrow s + 1$ 
14:   D:  $O[j] \leftarrow -O[j], j \leftarrow j - 1$ 
15:       goto A
```

- Here is an example of annotating an algorithms

ALGORITHMP($S[a_0, \dots, a_n]$):

```
1:  $C[1..n] \leftarrow 0, O[1..n] \leftarrow 1$ 
2: while TRUE:
3:   PRINT( $S$ )
4:    $j \leftarrow n, s \leftarrow 0$ 
5:   A:  $q \leftarrow C[j] + O[j]$ 
6:       if  $q < 0$ : goto D
7:       if  $q = j$ : goto B
8:       SWAP( $S, j - C[j] + s, j - q + s$ )
9:        $C[j] \leftarrow q$ 
10:      continue
11:   B: if  $j = 1$ :
12:       break
13:        $s \leftarrow s + 1$ 
14:   D:  $O[j] \leftarrow -O[j], j \leftarrow j - 1$ 
15:       goto A
```

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

Source Code

```
1  def algorithm_g(n):
2      a = [0 for _ in range(n + 1)]
3      while True:
4          curr = a[1 : n + 1][::-1]
5          yield "".join([str(i) for i in curr])
6
7          a[0] = 1 - a[0]
8          j = 1
9          while a[j - 1] != 1:
10             j += 1
11             if j == n + 1:
12                 return
13             a[j] = 1 - a[j]
```

Theorems and Lemmas

Lemma

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

Proof

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

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

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:

$$f(n) = \begin{cases} f\left(\frac{n}{2}\right) & n \text{ even} \\ f(3n+1) & \text{otherwise} \end{cases}$$

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.