[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

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- colors are cool

## Some Math Mode Testing

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

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

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

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**The proof uses *reductio ad absurdum*.**

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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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\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
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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

$$\Sigma \qquad \Sigma$$

# Demonstration of algo and nalgo env

GetRandomNumber():

return 4 ⟪ *chosen by fair dice roll.* ⟫
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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 ⟩⟩**

```
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

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

$C[1..n] \leftarrow 0, O[1..n] \leftarrow 1$
**while** TRUE:
  PRINT$(S)$
  $j \leftarrow n, s \leftarrow 0$
  **A:** $q \leftarrow C[j] + O[j]$
    **if** $q < 0$: goto **D**
    **if** $q = j$: goto **B**
    SWAP$(S, j - C[j] + s, j - q + s)$
    $C[j] \leftarrow q$
    continue
  **B:** **if** $j = 1$:
      break
    $s \leftarrow s + 1$
  **D:** $O[j] \leftarrow -O[j], j \leftarrow j - 1$
    goto **A**

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

# Source Code

```
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 $C^\infty$.

### 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 $C^\infty$ in each component, we have that it is $C^\infty$ 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.