Metropolis

A modern beamer theme

Matthias Vogelgesang

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Center for modern beamer themes

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Simple Proofs

Irrationality of $\sqrt{2}$

Theorem

The square root of two is irrational.

The following proof uses the *fundamental theorem of arithmetic*.

Proof.

For the sake of contradiction, assume that $\sqrt{2}$ is rational. Hence, there are integers $m, n \neq 0$ such that $\sqrt{2} = \frac{m}{n}$ or rather $\sqrt{2} \cdot n = m$. Squaring both sides yields $2 \cdot n^2 = m^2$. Clearly a contradiction. ∎

Infinitude of Primes

Theorem

There are infinitely many primes.

Lemma

The value of Riemann zeta function $\zeta(2)$ is trancendental, namely,

$$\zeta(2) = \prod_{p \in \mathbb{P}} \frac{1}{1 - \frac{1}{p^2}} = \frac{\pi^2}{6}.$$

Proof.

For the sake of contradiction, assume that there are only finitely many primes. Hence, $\zeta(2)$ is rational. Clearly a contradiction. ∎

Graph Examples

Properties of the Complete Graph

Let $G = K_7$ be the complete graph with seven vertices. G has several properties.

Example

- There is no vertex cover with only five vertices.

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- G has an Eulerian cycle with length 21.

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Let $G = K_7$ be the complete graph with seven vertices. G has several properties.

Example

- There is no vertex cover with only five vertices.
- G is not planar (only the K_1, K_2, K_3, and K_4 are).
- G has an Eulerian cycle with length 21.

Complexity Theory

Turing (Cook) Reductions

Recall that SAT and TAUT are **NP**-complete and **coNP**-complete, respectively.

Theorem

NP *and* ***coNP*** *are indistinguishable with respect to Cook reductions.*

Proof.

We show that SAT $\leq_C$ TAUT and then TAUT $\leq_C$ SAT. Let φ be a formula.

1. Note that φ is satisfiable *iff* $\neg\varphi$ is not a tautology.
2. Note that φ is a tautology *iff* φ is satifiable and $\neg\varphi$ is not.

Hence, the respective oracles can be used as follows:

procedure SAT(φ)
    return $\neg$TAUT($\neg\varphi$)
end procedure

procedure TAUT(φ)
    return SAT(φ) $\wedge$ $\neg$SAT($\neg\varphi$)
end procedure

∎

Conclusion

Summary

Get the source of this theme and the demo presentation from

`github.com/matze/mtheme`

Questions?

Backup slides

Sometimes, it is useful to add slides at the end of your presentation to refer to during audience questions.

The best way to do this is to include the `appendixnumberbeamer` package in your preamble and call `\appendix` before your backup slides.

METROPOLIS will automatically turn off slide numbering and progress bars for slides in the appendix.

References i

T. Tantau.
The BEAMER class.