Spring 2016 Welcome

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The constant γ

γ the Euler-Mascheroni constant

$$\gamma = 0.57723\ 56649\ 01532\ 86060\ 65120\ldots$$

$$\gamma = \lim_n \left(\sum_{k=1}^{n} \frac{1}{k} - \ln n \right)$$

$$\Gamma'(1) = -\gamma$$

If $\gamma = p/q$ then $q > 10^{242080}$

Talking Points

Grade Distributions
Email
Accommodations
ALEKS

ALEKS PLACEMENT EXAM REQUIREMENT
If this is your first FSU math course with the prefix MAC and you are a FTIC (First Time In College) student who entered Summer 15 or later, then you are required to take ALEKS. A progressive penalty will be applied to the first exam grade in this course if the ALEKS placement exam is not completed before 11:59 p.m. on the first day of classes (that is, the day posted by the registrar as the day “Classes Begin”). The grade penalty will increase if ALEKS is not completed within 48 hours after the first deadline and again 48 hours after the second deadline.

ALEKS is not

NOT a way to jump from MAC1105 to MAC2311
NOT a way to avoid repeating a course
NOT a way to avoid trigonometry – separate trig score

Something odd

The harmonic series

$$H_n = \sum_{k=1}^{n} \frac{1}{k}$$

is never an integer for $n > 1$.
Proof: Let 2^j be the largest power of two in $1 \ldots n$ and let $D = \text{lcm}\{1 \ldots n\}$. Note

$$\frac{1}{2^j} = \frac{N_0}{D} \text{ with } N_0 \text{ odd.}$$

$$\frac{1}{k} = \frac{N_k}{D} \text{ with } N_k \text{ even otherwise.}$$

$$\therefore H_n = \frac{N}{D} \text{ with } N \text{ odd and } D \text{ even.}$$

Email

Advisors (other than Pamela or Kari) are not your friend

- Do not reply to email from students wanting to add your class, just forward them to advisor@math.fsu.edu

Parents are not your friend.
The Dean of Students doesn't know the whole story.

Something Prime

Bertrand's postulate: There is always a prime number between k and $2k$.

Erös elementary proof: If there was no such prime, then the binomial coefficient

$$\binom{2n}{n} = \frac{(2n)!}{(n!)^2}$$

would be too small.

Non terminating rationals

H_n is a non-terminating rational for $n > 6$.
There is a prime $p \geq 7$ with $n/2 < p \leq n$. Let D be the lcm as before

$$\frac{1}{p} = \frac{N_0}{D}, \text{ with } N_0 \not\cong 0 \mod p$$

$$\frac{1}{k} = \frac{N_k}{D}, \text{ with } N_k \cong 0 \mod p$$

$$\therefore H_n = \frac{N}{D}, \text{ with } N \not\cong 0 \mod p$$

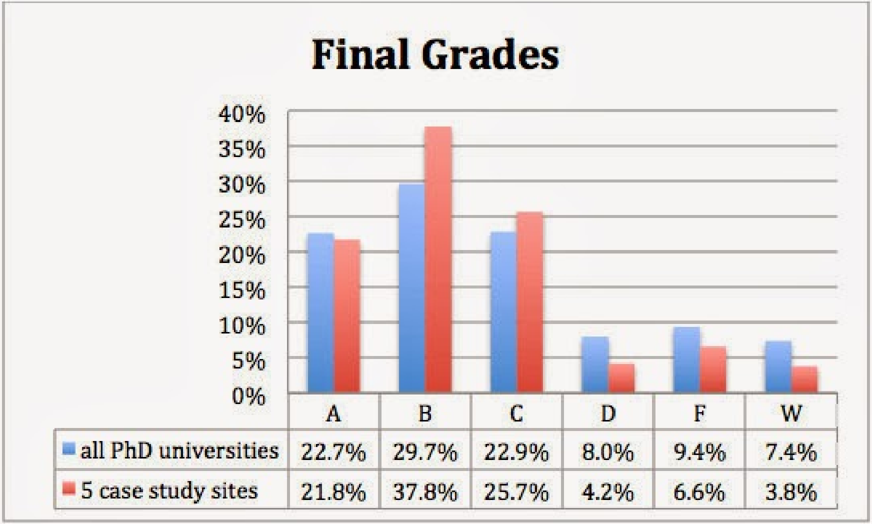
$$H_6 = \frac{147}{60} = \frac{49}{20} = 2.45$$

Accommodations

- The letter isn't the request. It is a basis for discussion.
- Unlimited Excused Absences. One extra excused absence.

Grade Distributions

http://www.maa.org/CSPCC

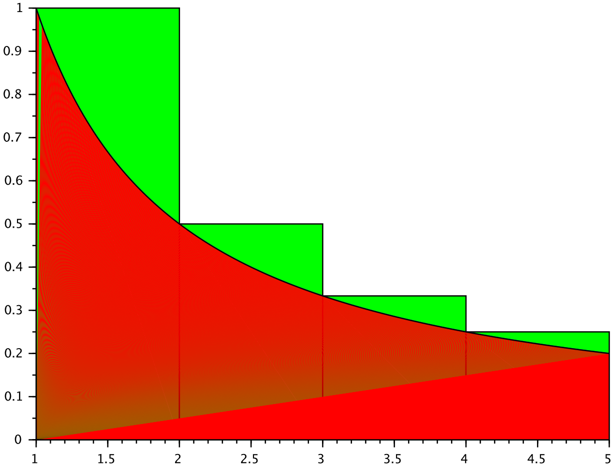


	A	B	C	D	F	W
all PhD universities	22.7%	29.7%	22.9%	8.0%	9.4%	7.4%
5 case study sites	21.8%	37.8%	25.7%	4.2%	6.6%	3.8%

Figure 1: Instructor reported final grades.

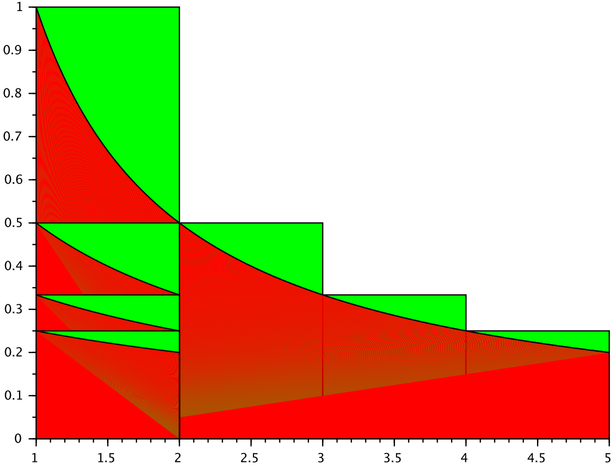
γ Geometrically

The area in green approachs γ



γ Geometrically

$$0.5 \leq \gamma \leq 1$$



Taylor series for $\ln(1+x)$

$$\frac{d}{dx}(\ln(1+x)) = \left(\frac{1}{1+x}\right) = \sum(-1)^n x^n$$

$$\ln(1+x) = \sum_{n=0}^{\infty}(-1)^n \frac{x^{n+1}}{n+1}$$

$$\ln(1+\frac{1}{r}) = \frac{1}{r} + \sum_{n=2}^{\infty}(-1)^{n-1}\frac{1}{nr^n}$$

$$\frac{1}{r} = \ln(1+\frac{1}{r}) + \sum_{n=2}^{\infty}(-1)^n \frac{1}{nr^n}$$

Telescoping Logs

$$\ln\left(1+\frac{1}{r}\right) = \ln\left(\frac{r+1}{r}\right)$$
$$= \ln(r+1) - \ln(r)$$

$$\sum_{r=1}^{n} \ln(1+1/r) = \ln(n+1) - \ln(1) = \ln(n+1)$$

Punch line

$$\sum_{r=1}^{n} \frac{1}{r} = \ln(n+1) + \frac{1}{2}\sum_{r=1}^{n} \frac{1}{r^2} - \frac{1}{3}\sum_{r=1}^{n} \frac{1}{r^3} + \dots$$

$$\sum_{r=1}^{n} \frac{1}{r} - \ln(n+1) = \sum_{k=2}^{\infty} (-1)^k \frac{1}{k} \sum_{r=1}^{n} \frac{1}{r^k}$$

The Alternating Series test gives an estimate on γ.

Finally

You have a lot of support, if you need help, ask.
You are the math department.