Welcome to MAT136 LEC0501 (Assaf)

Next week – We're going digital!
I don't care what the university says.

S9.1 – Sequences (AKA infinite lists)

Assaf Bar-Natan

"Yeah yeah 'cause it goes on and on and on
And it goes on and on and on yeah
I throw my hands up in the air sometimes
Saying ayeoh, gotta let go"

–"Dynamite", Taio Cruz

March 13, 2020

What is a sequence?

A sequence is an ordered list of numbers

We can give a sequence in a few ways:

- Explicity: $1, 4, 9, \ldots$ (like a table of values $f(n) = n^2$)
- Closed form: $c_n = \frac{1+2n}{3n-2}$ (like Taylor coefficients $c_n = \frac{1}{n!}\frac{d^n f}{dx^n}$)
- Recursive: $s_{n+1} = s_n + 1/n$ (like Euler's method)

Submissions Closed

Match the sequences given in different forms

✓ **71%** Answered Correctly

Correct Order

1	$s_n = s_{n-1} + 2$ and $s_1 = -1$	→	**C**	-1; 1; 3; 5; and so on	**98**
2	$\frac{n+1}{n}$	→	**A**	2; 3/2; 4/3; 5/4; and so on	**95**
3	1; 2; 4; 8; and so on	→	**B**	$s_n = 2^n$	**98**

March 13 at 12:14 PM results — Condense Text

130/130 answered — Ask Again

Open | Closed | Responses | Correct — 100%

Submissions Closed

Find a formula for the nth term of the sequence $\{1/2, -4/3, 9/4, -16/5, 25/6 \ldots\}$

✓ **63%** Answered Correctly

A	$(-1)^n n/(n+1)$	8
B	$(-1)^{n+1} n/(n+1)$	8
C	$(-1)^{n-1} n/(n+1)$	18
D	$(-1)^n n^2/(n+1)$	16
E	$(-1)^{n+1} n^2/(n+1)$	67
F	$(-1)^{n-1} n^2/(n+1)$	17

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134/134 answered | Ask Again

Open | Closed | Responses | Correct | 88%

Takeaway

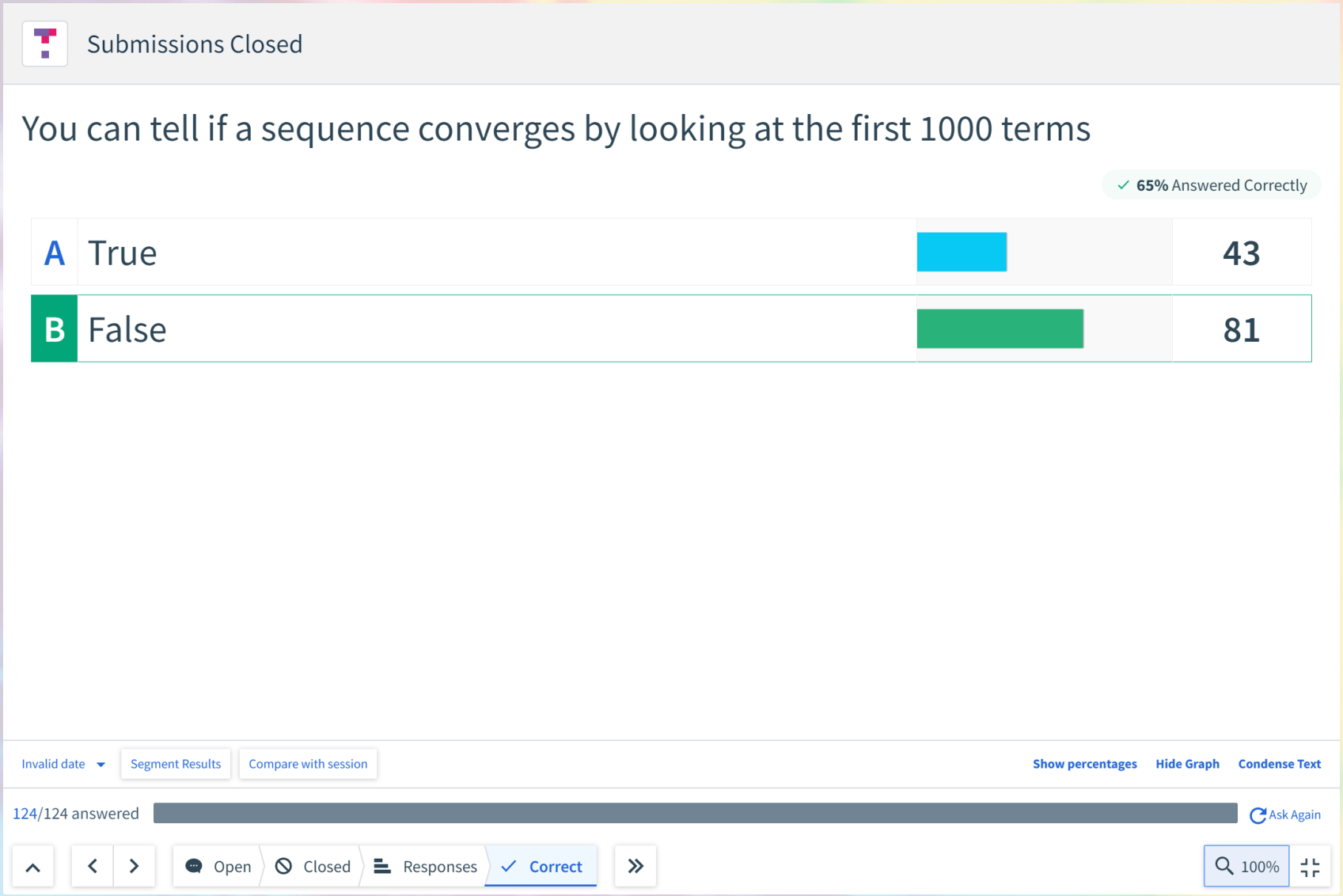
We can move back and forth between representations of sequences!

Fill in the Blanks

- If a sequence is m_____ and b_____, it converges.
- A sequence s_n converges to L if s_n is as close to _____ as we please if _____ is _____.
- A sequence is an _____ list of numbers.
- For a positive integer n, n! = _____.
- A sequence is _____ defined if the equation for a general term depends on previous terms.

Fill in the Blanks

- If a sequence is **monotonic** and **bounded**, it converges.
- A sequence s_n converges to L if s_n is as close to **L** as we please if **n** is **large**.
- A sequence is an **ordered** list of numbers.
- For a positive integer n, n! $=$ $n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1$.
- A sequence is **recursively** defined if the equation for a general term depends on previous terms.


Submissions Closed
You can tell if a sequence converges by looking at the first 1000 terms
65% Answered Correctly
A True
43
B False
81
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Segment Results
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Show percentages
Hide Graph
Condense Text
124/124 answered
Ask Again
Open
Closed
Responses
Correct
100%

Submissions Closed

What value does each of the following sequences converge to?

✓ **46%** Answered Correctly

Correct Order

1	$\left\{\frac{1+2n}{3n-2}\right\}$	→	**B** 2/3	**72**
2	$\left\{\frac{5+3^n}{10+2^n}\right\}$	→	**A** diverges	**66**
3	$\{3/2+e^{-2n}\}$	→	**D** 3/2	**73**
4	$\left\{3+(-1)^n\frac{1}{2^n}\right\}$	→	**C** 3	**74**

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125/125 answered Ask Again

Open Closed Responses ✓ Correct 88%

Takeaway

We have a few ways to check if a sequence converges. One way is to look at the closed form and plug in big numbers

Champernowne constant

Consider the sequence:

- $C_1 = 0.1$
- $C_2 = 0.12$
- $C_3 = 0.123$

Q: Does this sequence converge? How do you know this?

A: This sequence converges because it is monotonic and bounded.

Champernowne constant

The limit of the sequence $0.1, 0.12, 0.123, \ldots$ **is called Champernowne constant, and its decimal expansion contains every number. Even your phone number!**

And now, we meet our friends...

The gang

Inspiration for cat opening mouth question

Kittens in hay

Cats looking

Cuddles

Bulking up for winter

Sunset

Plans for the Future

For next time:

Go over WeBWork 9.2 and section 9.2