DOTE 6635: Artificial Intelligence for Business Research (Spring 2026)

What's New in AI

Renyu (Philip) Zhang

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What Happened Since We Last Met?

Nature's 10

Ten people who helped shape science in 2025

8 December 2025

Liang Wenfeng: Tech disruptor

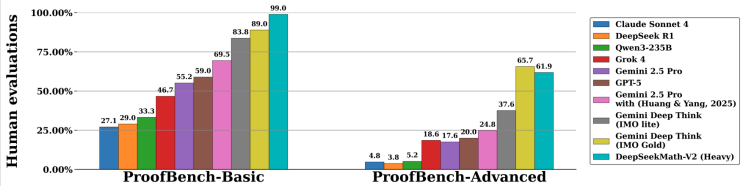
After making his name in investing, a Chinese finance wizard founded DeepSeek.

Article | Open access | Published: 17 September 2025

DeepSeek-R1 incentivizes reasoning in LLMs through reinforcement learning

Daya Guo, Dejian Yang, Haowei Zhang, Junxiao Song, Peiyi Wang, Qihao Zhu, Runxin Xu, Ruoyu Zhang, Shirong Ma, Xiao Bi, Xiaokang Zhang, Xingkai Yu, Yu Wu, Z. F. Wu, Zhibin Gou, Zhihong Shao, Zhuoshu Li, Ziyi Gao, Aixin Liu, Bing Xue, Bingxuan Wang, Bochao Wu, Bei Feng, Chengda Lu, ... Zhen Zhang + Show authors

Nature **645**, 633–638 (2025) | Cite this article



Contest	Problems	Points
IMO 2025	P1, P2, P3, P4, P5	83.3%
CMO 2024	P1, P2, P4, P5, P6	73.8%
Putnam 2024	A1 ~ B4, B5, B6	98.3%

Table 1 | Problems in gray are **fully solved**, while underlined problems received **partial credit**.

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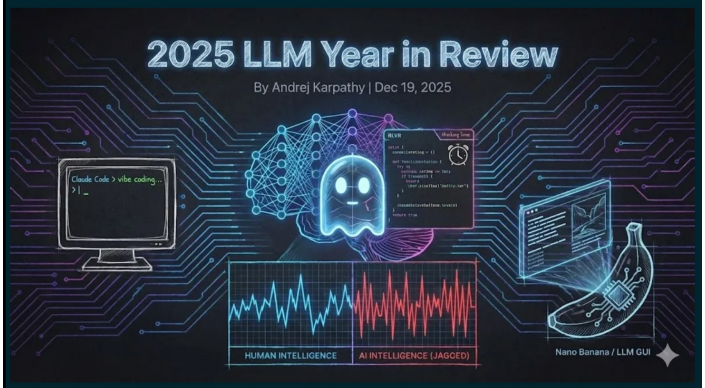
karpathy

Home Blog

2025 LLM Year in Review

20 Dec, 2025



2025 has been a strong and eventful year of progress in LLMs. The following is a list of personally notable and mildly surprising "paradigm changes" - things that altered the landscape and stood out to me conceptually.

https://karpathy.bearblog.dev/year-in-review-2025/

What Happened Since We Last Met?

1. Reinforcement Learning from Verifiable Rewards (RLVR)

2. Ghosts vs. Animals / Jagged Intelligence

3. Cursor / new layer of LLM apps

4. Claude Code / AI that lives on your computer

5. Vibe coding

6. Nano banana / LLM GUI

TLDR. 2025 was an exciting and mildly surprising year of LLMs. LLMs are emerging as a new kind of intelligence, simultaneously a lot smarter than I expected and a lot dumber than I expected. In any case they are extremely useful and I don't think the industry has realized anywhere near 10% of their potential even at present capability. Meanwhile, there are so many ideas to try and conceptually the field feels wide open. And as I mentioned on my Dwarkesh pod earlier this year, I simultaneously (and on the surface paradoxically) believe that we will both see rapid and continued progress *and* that yet there is a lot of work to be done. Strap in.

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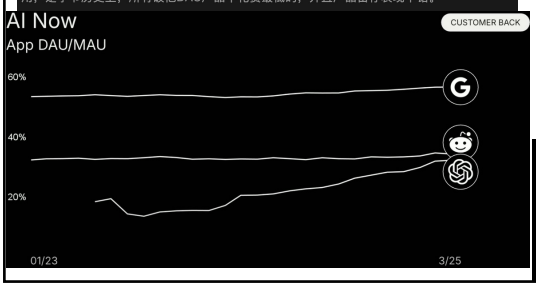
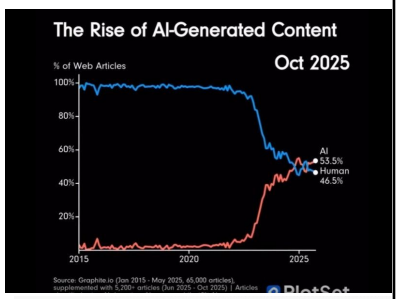
豆包DAU破亿，成字节史上推广费用最少的破亿产品

界面新闻 2025年12月24日 21:56

最新数据显示豆包的日均活跃用户数（DAU[8]）已突破1亿大关。豆包的UG、市场推广费用，是字节历史上，所有破亿DAU产品中花费最低的，并且产品留存表现不错。



What Happened Since We Last Met?



Compensation

$280K – $400K + Offers Equity

manus

The general AI agent

Meta just acquired a Chinese-founded AI startup for $2B. Here's why that matters

AI firm Manus claims its bot can make decisions with far less prompting than rivals

Jenna Benchetrit · CBC News · Posted: Dec 30, 2025 3:36 PM EST | Last Updated: December 31, 2025

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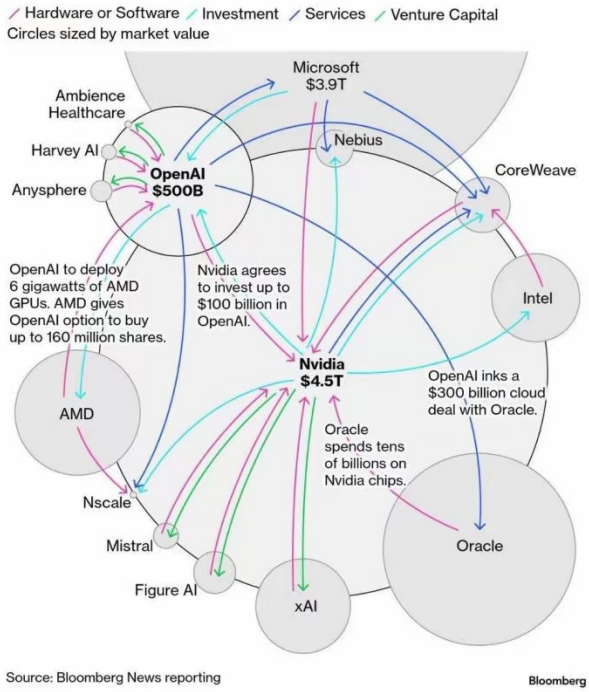
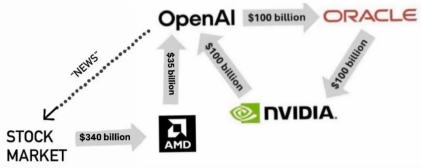


What Happened Since We Last Met?



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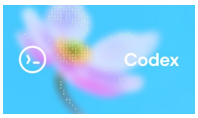
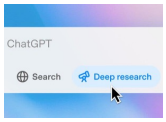
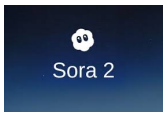
Maintrack: Facilitates Humans to Leverage Compute

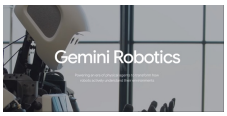
- AI Coding: Connecting human & compute
- Deep Research: Automation of information acquisition & processing
- World Model: Data-driven simulation of physical world
- AI Scientist: Automated hypothesis generation and validation





manus





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AI Starts to Replace Human Workers

At the age of AI, what talent is needed by the market?

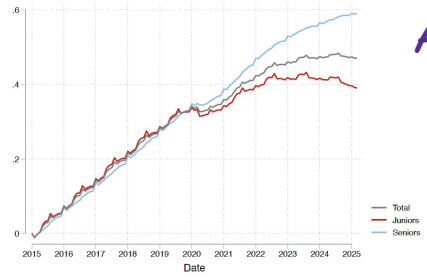


Figure 2: Time Series of Junior and Senior Employment in Sample Firms

Notes: This figure plots the average number of junior-level workers and senior-level workers in our sample of firms over time, normalized to 1 in January 2015. We define "junior" workers as those in Entry- or Junior-level positions, and "senior" workers as Associate level and above (see Section 3.1 for details).

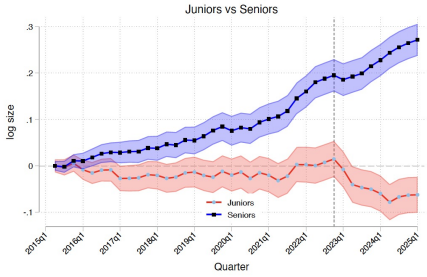


Figure 3: Employment Differences Between Adopters and Non-Adopters Over Time

Notes: The graph present the estimated coefficients β_j from Equation 1, ran separately to juniors and seniors. Standard errors are clustered in firm level.

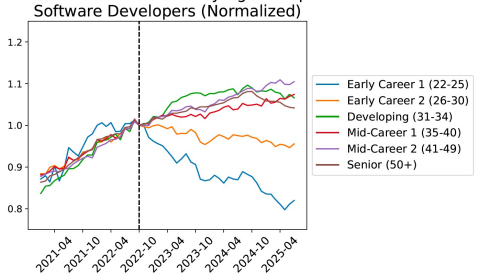
LEADERSHIP > CAREERS

It's Time To Get Concerned, Klarna, UPS, Duolingo, Cisco, And Many Other Companies Are Replacing Workers With AI

By Jack Kelly, Senior Contributor. ⓘ Jack Kelly covers career growth, job ... Follow Author

May 04, 2025, 09:52am EDT

Headcount Over Time by Age Group
Software Developers (Normalized)



At the age of AI, what education should business schools provide?

- First Principles
- Growth Mindset
- Paradigm Shift

https://digitaleconomy.stanford.edu/wp-content/uploads/2025/08/Canaries_BrynjolfssonChandarChen.pdf
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5425555
https://www.forbes.com/sites/jackkelly/2025/05/04/its-time-to-get-concerned-klarna-ups-duolingo-cisco-and-many-other-companies-are-replacing-workers-with-ai/

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Complete Replication of a PNAS Paper

https://github.com/andybhall/vbm-replication-extension

Universal vote-by-mail has no impact on partisan turnout or vote share

Daniel M. Thompson[a,1], Jennifer A. Wu[b,1], Jesse Yoder[a,1], and Andrew B. Hall[a,1,2]

[a]Department of Political Science, Stanford University, Stanford, CA 94305; and [b]Stanford Institute of Economic Policy Research, Stanford University, Stanford, CA 94305

Edited by Douglas S. Massey, Princeton University, Princeton, NJ, and approved May 6, 2020 (received for review April 15, 2020)

In response to coronavirus disease 2019 (COVID-19), many scholars and policy makers are urging the United States to expand voting-by-mail programs to safeguard the electoral process. What are the effects of vote-by-mail? In this paper, we provide a comprehensive design-based analysis of the effect of universal vote-by-mail—a policy under which every voter is mailed a ballot in advance of the election—on electoral outcomes. We collect data from 1996 to 2018 on all three US states that implemented universal vote-by-mail in a staggered fashion across counties, allowing us to use a difference-in-differences design at the county level to estimate causal effects. We find that 1) universal vote-by-mail does not appear to affect either party's share of turnout, 2) universal vote-by-mail does not appear to increase either party's vote share, and 3) universal vote-by-mail modestly increases overall average turnout rates, in line with previous estimates. All three conclusions support the conventional wisdom of election administration experts and contradict many popular claims in the media.

vote-by-mail | elections | COVID-19 | partisanship

The coronavirus disease 2019 (COVID-19) pandemic threatens the 2020 US election. Fears that the pandemic could deter many people from voting—or cause them to become infected if they do vote—have spurred calls for major electoral reforms. As election administration experts Nathaniel Persily and Charles Stewart put it, "The nation must act now to ensure receive an absentee ballot, while stopping short of moving to universal VBM; as such, by studying a more dramatic version of the recommended policies, our paper provides a useful upper bound related to these discussions." While a large literature in political science studies various forms of convenience voting—see *SI Appendix*, Table S1 for a full review—there has not been any comprehensive analysis of VBM that employs clear designs for causal inference to estimate effects on partisan outcomes.[†] The existing research supporting the neutral partisan effects of VBM compares turnout in Oregon before and after it implemented

Significance

In response to COVID-19, many scholars and policy makers are urging the United States to expand voting-by-mail programs to safeguard the electoral process, but there are concerns that such a policy could favor one party over the other. We estimate the effects of universal vote-by-mail, a policy under which every voter is mailed a ballot in advance of the election, on partisan election outcomes. We find that universal vote-by-mail does not affect either party's share of turnout or either party's vote share. These conclusions support the conventional wisdom of election administration experts and contradict many popular claims in the media. Our results imply that the partisan outcomes of vote-by-mail elections closely resemble in-person elections, at least in normal times.

Model Information

- **Model:** Claude Opus 4.5 (claude-opus-4-5-20251101)
- **Interface:** Claude Code CLI
- **Date:** January 2026

Jan 13, 2026

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Complete Replication of a PNAS Paper

https://github.com/andybhall/vbm-replication-extension/blob/main/INSTRUCTIONS.md

AI-Generated Academic Paper: Replicating and Extending "Universal Vote-by-Mail Has No Impact on Partisan Turnout or Vote Share"

Project Overview

You are tasked with producing a complete academic political science paper by replicating and extending Thompson, Wu, Yoder, and Hall (2020), published in PNAS. The original paper used a difference-in-differences design to estimate the causal effects of universal vote-by-mail (VBM) on partisan electoral outcomes, finding null partisan effects and a modest (~2 percentage point) increase in overall turnout.

Your task:

1. Replicate the original findings using the authors' published replication data and code
2. Extend the analysis by collecting new data for the same three states (California, Utah, Washington) through 2024
3. Test whether the null partisan findings hold in the post-COVID era

Original paper: https://www.pnas.org/doi/10.1073/pnas.2007249117
Original replication materials: https://github.com/stanford-dpl/vbm

IMPORTANT: Stop-and-Check Points

Throughout this project, there are mandatory **STOP AND CHECK** points marked with 🔴. At each of these points, you must:

1. Summarize what you have completed
2. Present key outputs for review
3. List any issues or concerns
4. **Wait for human approval before proceeding**

Do not proceed past a 🔴 checkpoint without explicit approval.

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Complete Replication of a PNAS Paper

https://github.com/andybhall/vbm-replication-extension/blob/main/CLAUDE_CODE_PROMPTS.md

Phase 0: Project Setup

Initial Prompt:

> I want to replicate and extend Thompson et al. (2020) "Universal Vote-by-Mail Has No Impact on Partisan Turnout or Vote Share" from PNAS. The paper studies California's Voter's Choice Act. I have the original replication data. Please set up the project structure and review the original materials.

Phase 1: Literature Review

Prompt:

> Approved, proceed to Phase 1: Literature Review

Phase 2: Replication

Prompt:

> Approved, proceed to Phase 2

Phase 3: Extension Data Collection

Prompt:

> Approved, proceed to Phase 3

Phase 4: Data Preparation

Prompt:

> Approved, proceed to Phase 4

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Complete Replication of a PNAS Paper

https://github.com/andybhall/vbm-replication-extension/blob/main/CLAUDE_CODE_PROMPTS.md

Phase 5: Extension Analysis

Prompt:

> Approved, proceed to Phase 5

Phase 6: Paper Writing

Prompt:

> Approved, proceed to Phase 6

Phase 7: Final Deliverables

Prompt:

> Approved, proceed to Phase 7

Bug Fix Session

Prompt:

> Can you take a look at the event study? It seems like something may be wrong with the turnout one since it's not showing the same positive effect as all the regressions (which I trust more) are showing

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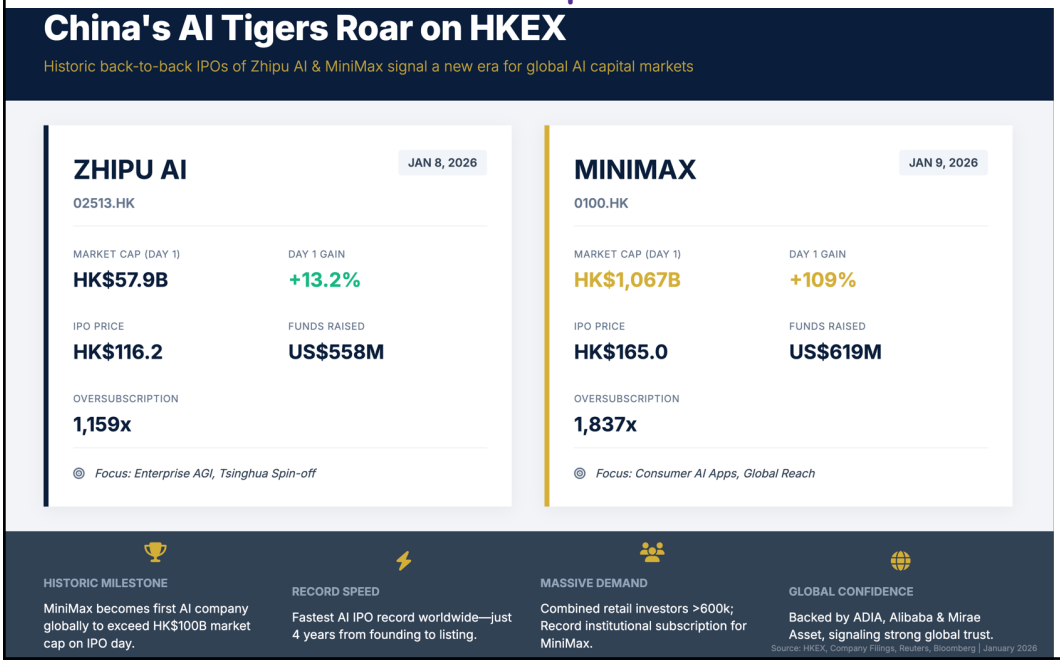
IPOs of Zhipu AI and MiniMax



https://www.scmp.com/tech/tech-trends/article/3339301/minimax-and-zhipus-stellar-hong-kong-ipos-supercharge-chinas-ai-ambitions

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DeepSeek to Disrupt the World Again?

News · Artificial Intelligence

Insiders Say DeepSeek V4 Will Beat Claude and ChatGPT at Coding, Launch Within Weeks

DeepSeek's upcoming V4 model could outperform Claude and ChatGPT in coding tasks, according to insiders—with its purported release nearing.

By Jose Antonio Lanz
Edited by Andrew Hayward

Jan 10, 2026
4 min read

Capability	Description
Long Code Prompts	A significant breakthrough in handling and parsing extremely long code prompts, offering a major advantage for developers working on complex software projects 6 .
Data Pattern Understanding	Improved ability to understand data patterns across the entire training pipeline, with no observed degradation in performance 6 .
Reasoning Ability	The model's outputs are described as more logically rigorous and clear, indicating stronger reasoning capabilities and greater reliability for complex tasks 6 .

https://tech.yahoo.com/ai/articles/insiders-deepseek-v4-beat-claude-205234497.html

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AI for Math by AxiomProver

Axiom ✓ Following
5,629 followers
1d

AxiomProver solved all 12 Putnam 2025 problems. Today we're releasing the Lean proofs.

We also put together our take on the problems, proof visualizations, and a look at how humans and AI approached things differently. Lots of fun math and Lean.

We sorted our findings into three categories:

Some problems are trivial for humans but tedious for AI. Calculus (A2, B2) and combinatorial constructions (A5) fall here. A positivity lemma humans find obvious takes chunks of Lean to satisfy the formal checker. After a combinatorial construction that's natural to see, our A5 formalization is 2054 lines and took 518 minutes. Combinatorics are friendly beasts to AI and analysis formalization could make one grumpy.

Some problems were surprisingly within reach. AxiomProver doesn't have a Euclidean geometry engine, so we didn't expect it to get B1. It reduced everything to symbols and pushed through. It also handled the combinatorial game theory question (A3) cleanly -- usually a tough domain for AI as we observed in last two years' model performance in the IMO.

Some problems got completely different solutions. On A4, our mathematicians thought algebraically. AxiomProver went geometric. On B4, we found one picture that settles it elegantly. AxiomProver chose 1061 lines of combinatorial bookkeeping. No picture, just grinding through cases until the result falls out.

The one that stunned us: A6. None of our in-house mathematicians finished it. AxiomProver did.

What's hard for humans and what's hard for machines are different questions. Understanding that gap matters as we are closing it.

Grothendieck uses the rising sea metaphor to say, don't attack the problem, raise the water level until it surrounds the land.

When will AI bring in definitions, build theories, choose the right abstraction to make problems dissolve?

We are not there yet. But days like this makes it feel closer.

Problem	Time to Solve	Tokens Used	Proof Length (Lines)	Theorems Generated	Tactics Used
A1	110 minutes	7,000,000	652	23	561
A2	185 minutes	6,000,000	556	26	581
A3	165 minutes	8,000,000	1,333	78	1,701
A4	107 minutes	8,000,000	960	32	1,107
A5*	518 minutes	9,100,000	2,054	52	3,074
A6*	259 minutes	16,000,000	588	28	670
B1	270 minutes	7,000,000	1,386	49	1,841
B2	65 minutes	2,000,000	417	28	325
B3	43 minutes	2,900,000	340	11	422
B4*	112 minutes	249,000	1,061	23	1,433
B5	354 minutes	18,000,000	1,495	66	1,967
B6*	494 minutes	21,000,000	1,019	30	1,052

"*" means AxiomProver solved the problem in the followng day.

https://github.com/AxiomMath/putnam2025

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Human Performance of Putman 2025

SCORE-TO-RANK CORRESPONDENCE

A participant is said to have rank n if $n-1$ participants scored higher. There were 3988 participants in the competition.

Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
90	1	64	32	49	96	35	202	21	505	7	1335
87	2	63	34	48	100	34	208	20	546	6	1344
81	3	62	37	47	106	33	220	19	641	5	1373
80	4	61	38	46	109	32	238	18	669	4	1428
78	6	60	45	45	111	31	254	17	686	3	1557
75	9	59	52	44	116	30	272	16	698	2	1760
74	10	58	58	43	119	29	295	15	713	1	2408
72	11	57	61	42	126	28	313	14	750	0	2807
71	13	55	64	41	137	27	328	13	820		
70	17	54	66	40	150	26	337	12	905		
69	18	53	69	39	173	25	349	11	1090		
67	23	52	76	38	180	24	374	10	1171		
66	26	51	79	37	194	23	404	9	1274		
65	30	50	87	36	198	22	449	8	1305		

About 4'000 students participated in Putman 2025.

FREQUENCY DISTRIBUTION OF PROBLEM SCORES OF THE TOP 504 CONTESTANTS

Score	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6
10	449	93	29	112	5	0	375	81	75	95	1	0
9	28	10	1	11	3	1	25	76	21	39	0	1
8	1	99	8	15	3	0	11	17	9	5	0	0
7	0	11	2	13	0	0	4	7	0	0	0	2
6	0	0	0	1	0	0	0	0	0	0	0	1
5	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
3	4	36	1	27	0	0	2	12	43	23	0	2
2	13	88	8	10	3	0	48	21	70	32	82	2
1	3	24	29	52	0	9	16	54	80	14	81	0
0	1	85	154	34	163	65	10	84	43	77	41	29
NA	5	58	272	229	327	429	13	152	163	219	299	467

https://maa.org/wp-content/uploads/2025/03/2024-William-Lowell-Putnam-Competition-Announcement-of-Winners.pdf Jan 13, 2026

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