Columbia Science Olympiad
2025 Fermi Questions Exam

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INSTRUCTIONS

- **DO NOT WRITE ON THIS EXAM!** It will be re-used for other teams. **ONLY the answer sheet will be graded.**
- You have **50 minutes** to solve **40 questions**, which are in no particular order of difficulty.
- No additional resources are allowed other than **pencils and scratch paper**.
- (Unless otherwise specified) Recall that answers should just be the degree of the exponent (power of ten). Round your answers (e.g. if you calculate $3.67 * 10^7$, round to 10^7 and write down **7**. If you estimate $5 * 10^2$, round to 10^3, and you should write down **3**). Answers in "alternative" formats **will be interpreted** as exponents (e.g. writing 10^5 on the answer sheet will be viewed as a raw value of 10^{10^5}).
- (Unless otherwise specified) Scoring will work as normal – 1 point for a ± 2 order of magnitude, 3 points for ± 1, and 5 points for the correct order of magnitude approximation.

QUESTION BOOST

- A **boost** causes a question to double the points it gives (to $2, 6, 10$ possible points).
- **The answer sheet has space for you to boost up to 3 questions** - simply write the question number in the corresponding boxes.

TIME BONUS

- **You get x bonus points** if you submit your test with x minutes remaining. (e.g. if you submit with the timer saying $26:54$, we will add 26 extra points to your final score).

Section 1. Real-world Cases (15 problems)

1. (5 points) Let's start off with a question so simple, you can calculate it on one hand! **On average in the U.S., how many fingers does a hand have?**

2. (5 points) In *Despicable Me*, Gru very evilly shrinks the moon using his SR-6 shrink ray. **How many times smaller would Gru need to shrink the moon for it to have the same density as osmium, the densest naturally occurring metal?** Calculate this based on the volume of the shrunken moon compared to the volume of the original.

3. (5 points) In *Minecraft*, worlds are millions of blocks wide. They are generated based on a "seed", an integer value that predetermines how the corresponding Minecraft world will be generated. **How many times greater is the number of possible worlds in Minecraft compared to Minecraft's monthly active user count, per Q4 2024**?

4. (5 points) Stenographers are those people in courtrooms who type really fast to transcribe everything that occurs during a trial. They actually use special keyboards (not your standard QWERTY keyboard) to type especially quick. **How many minutes would it take for the fastest stenographers to type the Bible?**

5. (5 points) The movie *Lord of War* starts with a shot of Nicholas Cage standing amidst piles and piles of bullets. **How many rounds of small-arms ammunition did the U.S. manufacture during World War II?**

6. (5 points) If summer vacation was actually 104 days long, **how many times could you watch the entire *Phineas and Ferb* TV show within those 104 days?**

7. (5 points) One of the great American creations of all time, in my opinion, is Costco. There's simply nothing like walking into Costco and knowing that you're about to drop $200 on a 50-pack of toilet paper or something equally absurd. **How many unique items does the average Costco warehouse carry?**

8. (5 points) 2024 was a big year for Bitcoin: the value of a single bitcoin reached $100,000 for the first time! **How many times more is the value of all bitcoin in circulation compared to the GDP of Tuvalu (the country with the smallest GDP)?**

9. (5 points) The Louisiana Purchase was known to be a great deal for the U.S., and a subpar deal for France. **If the U.S. were to buy all the land in its 50 states today at the same price per acre as the Louisiana Purchase, how much would it cost? Adjust for inflation, i.e. your answer should be in 2024 U.S. dollars.**

10. (5 points) Did you know the gold medals awarded at the Paris 2024 Olympics aren't solid gold? They're actually mainly composed of silver, with gold plating and a piece of the Eiffel Tower embedded as well. **How many Paris Olympic gold medals would we be able to construct before running out of iron from the Eiffel Tower?** Assume that we have an infinite supply of gold and silver (so the only limiting factor is our iron supply).

11. (5 points) In 2024, history was made when LeBron James and his son LeBron "Bronny" James Jr. teamed up, making it the first time that a father-son duo has played together in the NBA. **What proportion (in decimal form) of all points scored in NBA history (excluding G-league) have been scored by Bronny James?**

12. (5 points) In *Cars*, Lightning McQueen has a millisecond photo finish with Chick Hicks and Strip Weathers to cause a 3-way tie for the Piston Cup. **Assuming McQueen can maintain his top speed, how many milliseconds would it take for him to traverse all roads in the U.S.?**

13. (5 points) Assuming a constant and average growth rate, **what proportion (decimal form) of the distance from NYC to Tokyo, Japan would your fingernails reach if you never cut them your entire life?**

14. (5 points) One cool thing you can do in London is watch a Shakespeare play in the Globe Theater, the original location where his plays were acted out! **How many words are spoken by the Shakespeare character with the most lines?**

15. (5 points) My cat loves eating dried flowers (despite the fact that he cannot digest them and they make him sick). If cats *could* digest flowers, **how many days would it take for an average housecat to eat the entire yearly output of tulips from the Netherlands, assuming the cat is consuming its normal amount of calories per day, and is eating just the bulb of each tulip?**

Section 2. Columbia & NYC (10 problems)

16. (5 points) In the middle of campus there's an empty platform called The Sundial. There used to be a 14-ton granite ball here, but it went missing in 1946 and has never returned to campus since. **If we played a game of bowling with this 14-ton granite ball, how tall would the pins need to be, in inches, for the ball to be (proportionately) the correct size?**

17. (5 points) Ranger goes to Columbia, so I'm going to consider this a "Columbia" question. **What is the product of the nonzero digits of Ranger's phone number?**

18. (5 points) Many freshmen at Columbia live in John Jay residence hall, which is on the southwest corner of campus and has housed such dignitaries like Jake Gyllenhaal, Joseph Gordon-Levitt, and Federico García Lorca (and Brian Chen). **If we combined all dorm room space in John Jay Hall into one big room, how many pickleball courts could we fit in the resulting area?**

19. (5 points) Perhaps my all-time favorite movie is *Spider-Man: Into the Spider-Verse*. Brian disagrees since his opinion is wrong. **How long (in seconds) would *Into the Spider-Verse* be if every time someone said "spider", "Miles", or "Peter" then the full video of Columbia University's Graduation Commencement 2023 plays?**

20. (5 points) Ranger recently asked me what my favorite symphony was, which got me thinking about the composition of orchestras. **If we combined the strings from all of the string instruments in the 2024 New York Philharmonic orchestra into one long string, how many times could we wind the resulting string around a standard pencil?**

21. (5 points) The largest financial trading market in the world, by volume, is the New York Stock Exchange (NYSE) on Wall Street. **As of Jan 2025, How many seconds ago was the last time NYSE saw less than 1 million shares traded in a single day?**

22. (5 points) Every winter, Rockefeller Center in NYC puts up a massive Christmas tree decorated to the brim with lights and ornaments. **How many centimeters of wired lights are strung across the Rockefeller Christmas tree?**

23. (5 points) The "Subway Challenge" entails seeing how quickly one can traverse the entire NYC subway system, e.g. riding through every stop (on a single fare). The record has changed over time as new stops have been added, so now we ask you: **as of 2023, what is the fastest time anyone has ridden through every stop on the MTA subway system, in minutes?**

24. (5 points) *Masa* is an Omakase/Sushi restaurant in NYC, sometimes dubbed as the most expensive restaurant in America. Its menu has a single option: a price-fixed dinner for one, comprising of hand-made and chef-selected sashimi/sushi pieces. **Assuming for simplicity that Masa only served salmon for its dinner and could serve sashimi from any salmon in the sea, how much revenue (in USD) could Masa generate before the oceans ran out of salmon?**

25. (5 points) One of the best parts of NYC are the amazing museums it offers. Perhaps the most famous painting NYC currently houses is *The Starry Night* by Vincent van Gogh, on display at the Museum of Modern Art (MoMA). **How many pictures of *The Starry Night* have ever been taken**?

Section 3. Science & Math (5 problems)

26. (5 points) Adenosine triphosphate (ATP) is the high-energy molecule that powers nearly every process in our bodies — including your brain working hard to solve this exam! **How many ATP molecules will be used up by all 'Columbia Scioly Fermi Questions' test takers today?**

27. (5 points) Many forget that when ChatGPT answers a prompt, OpenAI's servers must run the AI models and expend energy to answer the prompt. **How many ChatGPT prompt queries will match the energy usage of a coffee machine brewing a single cup of coffee?**

28. (5 points) Among many other achievements, Enrico Fermi is famous for leading the Chicago Pile-1 experiment, the world's first nuclear reactor. **Using the power output from CP-1's first experimental run, how many seconds would it take to charge the original iPhone?**

29. (5 points) One of the longest isograms, a word with no repeated letters, in the English language is **"uncopyrightable"**. **How many anagrams of "uncopyrightable" are there such that none of the letters are placed in their original location?** E.g. "ucopyrightablen" should NOT be counted since this anagram has "u" in its original location.

30. (5 points) For positive integer n, **what is the smallest value of n such that $\sqrt{2} \cdot n$ is within 0.01 of an integer?**

Section 4. Perils of Percents (5 problems)

ATTENTION: For this section only, answering and scoring is different. For your answer, please write an integer between 0 and 100 inclusive, indicating a percentage. 5 points if you are ± 5 percentage points from the correct answer, 3 points for ± 10 percentage points from the correct answer, and 1 point for ± 15 percentage points from the correct answer. E.g: If the correct answer is 23% and your team writes "33", you will be awarded 3 points.

31. (5 points) One of my all-time favorite classes I've taken at Columbia is "Endangered Languages". **If we took 2 random people in the world, what is the probability that they share a common language (i.e. could have a mutually-intelligible conversation)?**

32. (5 points) The most important thing to know for this question is the. **What percent of all words a predominantly English-speaker reads, hears, or says is "the"?**

33. (5 points) A major consequence of global warming is rising sea levels, and already we see low areas like the Florida Everglades slowly getting submerged as icecaps melt. **What percent of the world population lives within 100km of the coastline?**

34. (5 points) Post college, I'm going to miss the amazing deal Spotify gives for student subscription plans. **As of 2024, what percent of global music industry revenue comes from streaming services?**

35. (5 points) Assuming for simplicity that the "solar system" means only the Sun and the 8 major planets, **what percent of the solar system's angular momentum is held by Jupiter?**

Section 5. Meta Questions (5 problems)

36. (5 points) This exam is typeset in a markup language called LaTeX. For instance, in LaTeX, $\frac{1}{2}$ is written as: \$\frac{1}{2}\$. **How many characters are in the LaTeX file for this exam (including solutions)?**

37. (5 points) **How many times will the good luck button, at the front of the room, be pressed by the end of all Fermi Questions sessions?** Feel free at any time to come up and press the button as many times as you'd like!

38. (5 points) **The correct answer to this question will be the 2nd most guessed answer (the "2nd mode" of all guesses) to this question.** We will take the median of all 2nd modes if there are ties.

39. (5 points) The usual scoring guidelines are adjusted for this problem, read carefully! **If you answer '1' to this question, you will get 2 points. If you answer '2' to this question, you will get 5 points. HOWEVER, if $\geq 50\%$ of test takers answer '2' then everyone who answered '2' will get 0 points instead.** (Any other answer will be given 0 points).

40. (5 points) The usual scoring guidelines are adjusted for this problem, read carefully! **You can write down any integer between 1 and 5, inclusive, for this problem. You will be awarded the number of points equal to the number you write down (e.g. if you write down 4, you will get 4 points). HOWEVER, if you write down the largest number out of any team (or tie for largest), you will get 0 points instead.** (Any answer outside the $[1, 5]$ range will be given 0 points and not count towards the 'largest number' calculation).

41. (1 point) **Write your own Fermi question, tell us a joke, draw a picture, literally do anything.** This question is 1 free point. You can leave any form of feedback below as well!

Congratulations on finishing the test! We hope you enjoyed solving these questions as much as we enjoyed crafting them. Regardless of how well you think you did, you should be proud of even completing such a challenge! Here's a photo of Brian's cat eating a plant as a reward for finishing:

Answer Sheet

Student Name(s): _____

Team Name: _____ **Team Number**: _____

School Name: _____

Questions to boost: ☐ ☐ ☐

Section 1: Real-world Cases

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

6. _____ 7. _____ 8. _____ 9. _____ 10. _____

11. _____ 12. _____ 13. _____ 14. _____ 15. _____

Section 2: Columbia & NYC

16. _____ 17. _____ 18. _____ 19. _____ 20. _____

21. _____ 22. _____ 23. _____ 24. _____ 25. _____

Section 3: Science & Math

26. _____ 27. _____ 28. _____ 29. _____ 30. _____

Section 4: Percents

31. _____ 32. _____ 33. _____ 34. _____ 35. _____

Section 5: Meta Questions

36. _____ 37. _____ 38. _____ 39. _____ 40. _____

41. Write your own Fermi question, tell us a joke, draw a picture, or literally do anything here.