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CS 5200 Homework 1

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1.

1. The estimated age of the Earth is 4.543 billion years (https://en.wikipedia.org/wiki/Earth).
2. The estimated age of the Solar System is 5 billion years (<http://earthguide.ucsd.edu/virtualmuseum/ita/05_3.shtml>).
3. The estimated age of the Milky Way is 13.21 billion years (<https://en.wikipedia.org/wiki/Milky_Way>).
4. The estimated age of the Universe is 13.82 billion years (<http://www.slate.com/blogs/bad_astronomy/2013/03/21/age_of_the_universe_planck_results_show_universe_is_13_82_billion_years.html>).
5. The estimated life span of Earth is 7.79 billion years (<https://www.livescience.com/39775-how-long-can-earth-support-life.html>)
6. Humans have roughly 1 billion years left on Earth. The mostly likely cause of this time limit is that the sun is heating up which will lead to oceans evaporating. We could stop the sun’s heat for a while longer with a massive space umbrella according to astronomer Roger Angel. (<https://theconversation.com/the-sun-wont-die-for-5-billion-years-so-why-do-humans-have-only-1-billion-years-left-on-earth-37379>, <http://www.bbc.com/future/story/20160425-how-a-giant-space-umbrella-could-stop-global-warming>)
7. The estimated lifespan of our solar system is approximately 10^21 years. After this, two black dwarf stars will randomly collide and destroy what little is left of our solar system (<https://www.forbes.com/sites/startswithabang/2017/01/27/how-our-solar-system-will-end-in-the-far-future/#7dcbe3074f4e>).
8. The estimated lifespan of the universe is 10^100 years. After this, the heat death of the universe will have set in enough to declare the universe lifeless (<https://en.wikipedia.org/wiki/Heat_death_of_the_universe>).
9. 2^64 - 1 = 18,446,743,999,999,999,999 seconds to complete the tower / 60 seconds per minute / 60 minutes per hour / 24 hours per day / 365 days per year = 584,942,415,017.7575 years / 10^100 years = 5.85 x 10^-87 percent of the life of the universe to complete the tower.

2.

1. 9 billion lines / 33 lines per college ruled paper = 272,727,273 sheets (rounded up).
2. Assuming a dollar per pack of 150 sheets of paper, $1.00 per pack / 150 sheets of paper per pack = 0.0067 cents per sheet of paper \* 272,727,273 sheets = $1,827,272.73. Assuming a filing cabinet can hold 2000 sheets of paper per drawer with 3 drawers = 6000 sheets of paper per cabinet. 272,727,273 sheets / 6000 sheets per cabinet = 45455 cabinets (rounded up).
3. The monks expected the task to take them around 15,000 years. Let’s assume that you could only write names for at most 8 hours a day (assuming a sane 8 hour work period per person), and one name would take about 15 seconds to write. Also assume each person wrote names every single day for a reasonable 40 years.

15000 years -> 7,884,000,000 minutes / 3 ( to account for 8 hour days) -> 2,628,000,000 minutes. 9,000,000,000 / 2,628,000,000 ~ 4 words per minute which is exactly how many words per minute one writer can do. 15000 years / 40 years per writer -> 375 writers

d. The computer was expected to output the names in 100 days. That would be 100 days \* 24 hours \* 60 minutes \* 60 seconds = 8,640,000 seconds. 9,000,000,000 words / 8,640,000 seconds ~ 1,042 words per second

e. I thought this story was an interesting mix of modern technology and religion. Typically the two are pitted against each other so it is nice to see them on the same side every now and then. Of course the story was very thought provoking, especially after hearing that the monks planned to write names for 15,000 years. I couldn’t help but to think of how much quicker a computer might be able to complete the process.

9. The result of my experiment with the anagram generators showed that both algorithms grew exponentially as the word size increased. The anagram generator I wrote that only involved one recursive call was significantly faster (roughly 3.5 times faster on large calculations) and required far fewer resources. I would expect these algorithms to be nearly unusable for any word over roughly 13 characters as it would take the computer about 3 days to calculate just one more character with the old algorithm and about an entire day with my algorithm.