Deadline: October 30 at 8pm eastern

CS1802 Honors Recitation 7

Fall 2020

October 27 - 30, 2020

Instructions: The problems in this recitation are based on the course material covered in the CS1800 lecture videos and are meant to prepare you for upcoming homework assignments. You earn full credit for a recitation by using your time well and demonstrating effort on the assignment. Submit your solution on Gradescope by uploading images of hand-written work, or uploading a PDF.

Logistics for Fall 2020: The recitation assignments are designed to be completed within the official 65-minute time. However, we know that schedules are harder to work with this semester, and so the deadline for recitations will officially be on Fridays at 8pm eastern. We recommend submitting your work in real-time at the end of your section, but it's OK if your preference is to submit later as long as you meet that last deadline.

- In-person: If you're able to join in-person, please come to the classroom where instructors will be there to help. Work on the assignment, ask us questions, and submit whatever you have when time is up.
- Synchronous, remote: If you're not able to join in-person but you can remotely join at the designated time, please join the recitation remotely. Work on the assignment, post any questions in the meeting chat, and submit whatever you have when the time is up.
- Asynchronous, remote: If you're both remote and not able to join in real-time, we suggest you register for the asynchronous online section. Dedicate 65 minutes to work on the assignment, and submit your solution by the Friday deadline.

Question 1.

In some city, 80% of the cabs are white and the other 20% are yellow. A cab was involved in an accident and ran away. An eyewitness to the accident claims that the cab was yellow. We know that the eyewitness tell the truth in 70% of the cases (and lies on the other 30%). What is the probability that the cab was indeed yellow?

Question 2.

★ A lost tourist arrives at a point with 3 roads. The first road brings him back to the same point after 1 hours of walk. The second road brings him back to the same point after 6 hours of walk. The last road leads to the city after 2 hours of walk. There are no signs on the roads. Assuming that the tourist chooses a road equally likely at all times. What is the average time until the tourist arrives to the city.

Question 3.

The Hat-Check Problem. There is a dinner party where n men check their hats. The hats are mixed up during dinner, so that afterward each man receives a hat at random (uniformly). What is the expected number of men who get their own hat?

Question 4.

For each sequence below, determine whether it is arithmetic, geometric, quadratic, or neither. If it is arithmetic, find the common difference. If its quadratic, find the difference as an arithmetic sequence. If it is geometric, find the common ratio. For each, also compute the close form formula.

(a) $4, 20, 100, 500, ...$

(b) $-28, -22, -16, -10, ...$

(c) $5, -7, -12, -19, ...$

(d) $5, -7, -19, -31, ...$

(e) $1, 3, 6, 10, 15, 21, ...$

Question 5.

Suppose your favorite donut shop is running a promotion. It costs \$.75 to buy one donut, \$1.45 to buy 2 donuts, \$2.10 to buy 3 donuts, \$2.70 to buy 4 donuts, and \$3.25 to buy 5 donuts. Assuming the pattern continues, how much does it cost to buy 12 donuts?

Question 6.

The following sequence represents the values of a summation from 1 to n as n grows increasingly large. $1, 5, 14, 30, 55, ...$

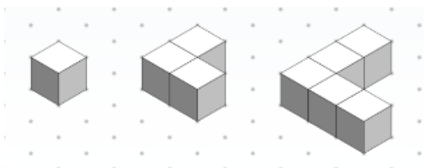
(a) What is the summation the sequence represents? $\sum_{i=1}^{n} \left[\texttt{your } i \texttt{ term here}\right]$.

(b) As you can see, the sequence is neither arithmetic nor geometric. Come up with a recursive formula for the sequence term a_n for an arbitrary n, something like $a_n = a_{n-1} + \texttt{what?}$

(c) The non-recursive formula for this summation is definitely harder than the recursive one. It's $\frac{n(n+1)(2n+1)}{6}$. Comig back to first part, using that and the formula here, calculate the sum for $n = 100$:
$\sum_{i=1}^{100} \left[\texttt{your } i \texttt{ term here}\right]$.

(d) Calculate the partial sum of consecutive terms from 50 to 100:
$\sum_{i=50}^{100} \left[\texttt{your } i \texttt{ term here}\right]$.

Question 7.



(a) Please enjoy these three cube diagrams I painstakingly drew over the course of like an hour (seriously). Each edge is length 2. Suppose we following the pattern established in the first three digrams and keep adding cubes. What would be the total volume represented in the 12th diagram?

(b) Now evaluate the total volume of the first n diagrams in two ways: (1) write in a sum the values you have for each diagram for $i = 1 : n$, (2) observe geometrically each diagrams can be "glued" in a certain way to the rest (already glued), forming larger square shapes. You should obtain a fomula which will also be proved later by induction.