CS-430 HW1 Fall 2022 10 points

The submission instructions:

- Due date: Thursday, Sept. 29, 11:59 pm Central Time (i.e. local time in Chicago)

- *Late submissions will not be accepted. 25% penalty for not following the remaining submission guidelines.*

- ***Absolutely no handwritten submissions. No credit will be given for such submissions.***

- Teamwork is allowed (max. 4 students/team). Individual submissions are also OK.

- Upload two files to Blackboard:
*- (1) your HW report (**pdf format only; the reports in formats other than pdf will be disregarded**);*
- (2) the source code of your program.
The Beacon students: please upload your submissions to LMS.

- ***One submission per team only.*** *Write down names, A#, and section (i.e. live, online, Beacon) of all the team members on the front page. Do **not** submit multiple copies of your HW (e.g. by each team member). It is very confusing and will be penalized.* ***Clearly indicate how each of your team members contributed to your teamwork.***

- My TAs are responsible for grading this HW. Don't send me or my TAs:
- Your partial solutions with inquiries "Is that what you expect?".
- Questions the answers to, may give explicit hints how to solve this problem.
Your self-sufficiency and creativity are also grading criteria of this HW.

1. Consider a certain algorithm whose complexity is given by the following recurrence

$$T(n+1)=T(n)\left(\frac{n^2+4n}{n^2+4n+3}\right)^n \frac{n+4}{n+1}$$ with the initial condition $T(1)=4$.

Find the asymptotic complexity of $T(n)$ by **investigating numerical results** of this recurrence. Feel free to use your favorite programming language. Submit the source code of your program along with your report (as clearly specified in the submission instructions).
(a) (3 points) Explain your methodology, i.e. how you can investigate the asymptotic behavior of this recurrence based on your numerical results. Justify that your proposed methodology is consistent with the definitions of $\Theta(\circ)$, $O(\circ)$ or $\Omega(\circ)$.
(b) (3 points) Calculate, present and analyze the numerical results of the subsequent steps of this recurrence. Report your observations and conclusions.

2. **(4 points)** Can you find an **analytical solution** to the recurrence given above? Feel free to use any methodology. Compare the analytical asymptotic complexity of $T(n)$ with the numerical one found in item (1). Are they the same? (no coding required; **theoretical analysis only**)