4.4.6 Problem Set: Confidence intervals and variability analysis

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1. In the `calc_mean_temp_rise_CI` function, determine and return the mean maximum temperature rise in the sample and the 95% confidence interval for its value in the population. Also print out this confidence interval using the same formatting and precision shown below. For the growth scenario:

```
dTmax mean: 7.42 K with 95% C.I. = [7.27, 7.58]
```

And for the decline scenario:

```
dTmax mean: 1.15 K with 95% C.I. = [1.07, 1.23]
```

Note: The 5th- and 95th-percentile values reported in the previous part are not related to the 95% confidence interval!

2. In the `calc_threshold_probability_CI` function, determine the probability that the maximum temperature rise in the sample is below 0.5 K. Also determine the 95% confidence interval for this probability. Print out this confidence interval using the same formatting and precision shown below. For the growth scenario:

```
P(dTmax < 0.5 K) = 0.000 with 95% C.I. = [0.000,
0.000]
```

And for the decline scenario:

```
P(dTmax < 0.5 K) = 0.070 with 95% C.I. = [0.020,
0.120]
```

Note: A temperature increase of about 0.5 K above the atmosphere's current temperature is generally agreed will lead to some significant impacts on humanity.

3. In this last step, we wish to do some analysis to determine which of the parameter variabilities has the greatest impact on the maximum temperature rise. To do that, in the `plot_threshold_variability` function, construct two-dimensional scatter plots of the sampled parameter outcomes, which are colored (1) **blue** for outcomes that led to a temperature rise below 0.5 K, and (2) **red** for all other outcomes.

Note: Please be sure to use the `scatter` function to plot the parameter outcomes, so that the grader can look up the data in your plots. Your plots should look similar to Figures 4.22 and 4.23. Make sure the plot titles and axis labels match the figures exactly. (You may have to resize the figure to see some of the x-axis labels. Don't worry about this for submission. The grader will be able to find them if they are there.)

Based upon these results, think about which of the parameter uncertainties (i.e. C, τ_H, or τ_C) has the biggest impact on the

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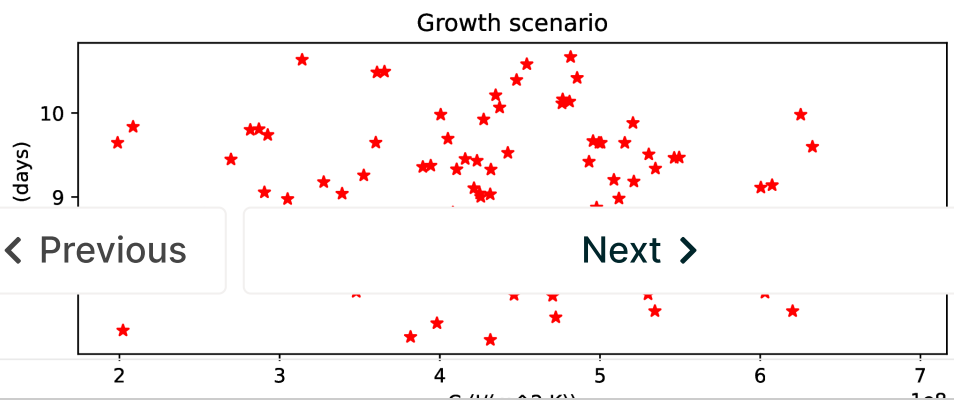
maximum temperature rise. (This is just a thought exercise. There is nothing else to turn in for this last question, beyond generating the scatter plots.)



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