Below are several exercises that we will be covering in the upcoming tutorial (Friday, Jan. 28). We will release these exercises in advance of the tutorial so that you get a chance to attempt the exercises yourself before we discuss them in tutorial. The course staff running the tutorial will go through each problem (time permitting) and show their process for how they would complete these questions in an assignment/exam setting. Being familiar with the questions before attending tutorial will help to ensure that you get the most out of our explanations.

Note that tutorials are not mandatory in CS135. We never cover any new material that you won’t have seen in lectures, and instead choose to highlight techniques and concepts from the most recent lectures to give you some extra practice. If you are very comfortable with the material that we covered and could easily complete the below questions, then you aren’t obligated to attend tutorials. Be very cautious with this though since sometimes questions can seem easy until you actually sit down and attempt them.

Question 1: Sphere Summary

Given the radius (in cm) of a sphere, write a function \((sphere\text{-summary} \ radius)\) to produce a list with two elements: the sphere’s surface area and volume, respectively. To compute these values, you may use:

\[
\text{Surface area: } SA = 4\pi r^2 \quad \text{Volume: } V = \frac{4}{3}\pi r^3
\]

Example:

\[(sphere\text{-summary} 5) \rightarrow (\text{cons} 314.16 (\text{cons} 523.60 \text{empty}))\]

Question 2: Race

Three cars are racing on straight racetrack that is 10 km long. Each car is represented by a list of \(x\)-pos (the car’s current distance from the starting line, in m) and speed (in m/s representing how fast the car is going). Write a function \((race\text{-winner} \ car1 \ car2 \ car3)\) to produce a single symbol, ‘car1’, ‘car2’, or ‘car3’, indicating the car that will win the race, given that each car’s speed remains constant. Ties are broken by the lowest numbered car, so there will never be a draw. For example, if car1 and car3 tie, car1 wins. Note: You may assume that all cars want to win the race, so their speeds are all positive (no cars are stopped or going in reverse), and no car has reached the end of the track.

Example:

\[(race\text{-winner} (\text{cons} 0 (\text{cons} 5 \text{empty}))
\begin{align*}
(\text{cons} 0 (\text{cons} 4 \text{empty})) \\
(\text{cons} 1 (\text{cons} 3 \text{empty]))) \rightarrow & \ ‘\text{car1}'
\end{align*}\]
Question 3: Rock Paper Scissors - Best of Three

You and your friend are still settling disputes with rock paper scissors, but you’re tired of always losing the first match. Maybe you should stop always selecting rock… or maybe your win rate would increase if you just played a few more matches! You decide to switch things up and see who will win a best of three.

Write a function \( (\text{rps-best-of-3 } \text{p1-actions } \text{p2-actions}) \) which consumes two lists, each containing exactly three symbols: \( \text{p1-actions} \) is the ordered list of actions (either ‘rock, ‘paper, or ‘scissors) taken by player 1, while \( \text{p2-actions} \) is the ordered list of actions taken by player 2 over the three matches. Player 1 wins the best of three if they have won strictly more matches than player 2. If both players have won the same number of matches, the outcome is a draw. The function should produce a symbol representing one of three possible outcomes: either ‘p1-wins, ‘p2-wins, or ‘draw.

Hint: This problem is a continuation of the first exercise from Tutorial 02. How could you use or modify \( \text{rps-result} \) to facilitate solving this problem?

Examples:

\[
(\text{rps-best-of-3} \ (\text{cons} \ '\text{rock} \ (\text{cons} \ '\text{paper} \ (\text{cons} \ '\text{scissors empty}))))
\ (\text{cons} \ '\text{scissors} \ (\text{cons} \ '\text{paper} \ (\text{cons} \ '\text{paper empty})))) \rightarrow \ '\text{p1-wins}
\]

\[
(\text{rps-best-of-3} \ (\text{cons} \ '\text{rock} \ (\text{cons} \ '\text{paper} \ (\text{cons} \ '\text{scissors empty}))))
\ (\text{cons} \ '\text{paper} \ (\text{cons} \ '\text{paper} \ (\text{cons} \ '\text{paper empty})))) \rightarrow \ '\text{draw}
\]