# Introduction

This assignment is your first group project for `Foundations`. It is designed to teach you how group work is to be done in this class. The method for the group work may seem either silly or overly scripted. It is actually drawn from research on brain function and learning theory. I ask that you do your best to follow the plan but feel free to let me know if, for some reason, this method interferes with *your* learning style.

[Based in part on documents found on cspogil.org.]

# Note

- By **design**, this assignment includes questions about topics that you have not yet seen in lecture. This encourages *creative* exploration and *constructing* your own mental models.
- Your group is expected to work together on *each* question: the goal is **not** to fill in the "right" answers as quickly as possible but rather to take the time to read, think, and discuss the material **together**.
- Constructing your own model is **short-circuited** by reading or parroting another thinker's answer. This means you should, as much as possible, use *recall* of class material, looking up definitions in *notes* or the *textbook* when necessary, and *avoid* just typing the question into a search engine on the Web. If you want more information, feel free to search **after** the group work is finished.
- Each student in the group has more or less experience with the topics in the assignment. If you have greater familiarity with the topics, *please* hold back a little bit so others can engage with building their own knowledge. You, too, must engage because there is always more to learn.

# Assignment Goals

After completing this group assignment, each student is expected to be able to Learning Outcomes

- Name the members of your group.
- Describe the *four* roles in the POGIL method.
- Read superscript notation for subsets of the integers.
- Expand simple $\sum$ notation and go the other way.

# Procedure

**Get out paper.** The group will turn in *one* document. Place the names of all present group members atop the page. This page will also be used by the speaker when answering questions at the end of the class.
**Copy each question before the answer.** This makes the answer sheet a worthwhile study guide w/o the worksheet. The answers written down should be *discussed* by the group and represent the *consensus* of the group. Sometimes a *picture*, a *graph*, or something similar is the most appropriate way to answer a question.
**Assign Roles.** Students should take roles they have not held recently (or, perhaps, ever):

**Manager** Move discussion forward.
**Reflector** Monitor that everyone gets heard and is caught up. (This is a **group** obligation, really.)
**Speaker** Asks the facilitator questions and communicates what the team has done.
**Recorder** Writes the report.

**Answer these questions.**

1. *Introduce* yourself to your fellow group members, including completions to the following prompts. These are designed to help each of you be more comfortable with being **wrong** in front of one another. **Mistakes** are a major part of learning.
   (a) The *longest* computer program I have ever written was ....
   (b) The most *challenging* computer bug I have ever had to solve was ....

2. Read the *Four Roles* cards (pass them around).
   (a) *List* the names of the four roles we will use in our group work this semester.
   (b) *Assign* each of the roles to a member of your group. If there are only three members, combine **Reflector** and **Speaker**; if there are more members than roles, there is always next week.
   (c) Each team member should read their role description. Then, without copying the card, **write** a short paragraph summarizing, in their own words, how their role fits into the *group* answering the questions.
   When the descriptions are done, the group comes back together and each person shares their summary with the group.
3. What is an *integer*? Give an example of a *number* that **is** an integer. Give an example of a number that **is not** an integer.

The symbol $\mathbb{Z}$ stands for the set of **all** integers, $\{\cdots -3, -2, -1, 0, 1, 2, 3, \dots\}$. $\mathbb{Z}^{>0}$ is limited to the set of *positive* integers and $\mathbb{Z}^{\leq -250}$ would be all integers less than or equal to $-250$

4. List the five lowest value elements in $\mathbb{Z}^{>0}$.
5. List the five lowest value elements in $\mathbb{Z}^{\geq 0}$. What's the difference with the previous answer?
6. Write out the *sum* of the first (lowest) five elements in $\mathbb{Z}^{>0}$. That is, list the elements with $+$ signs between them. Calculate the sum.
7. Write out the *sum* of the **squares** of the first (lowest) five elements in $\mathbb{Z}^{>0}$. That is, list the elements, with the superscript 2, with $+$ signs between them. Calculate the sum.
8. Write out the *sum* of the integers in the set $\{5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$. That is, list the elements with plus signs. Then calculate the sum. What makes this question more tedious than the previous ones?

The $\sum$ symbol, read as "sum" or "Sigma" (the Greek letter), is used by mathematicians to represent a sum across some set of values. Thus the sum of all integers from 5 to 15, inclusive, would be written $\sum_{i=5}^{15} i$.

Notice that the variable $i$ takes on *each* of the values from the **start**, shown below the sum, to the **end**, shown atop the sum. After the $\sum$ is the formula to sum.

9. Rewrite the *sum* of the first (lowest) five elements in $\mathbb{Z}^{>0}$ with the $\sum$ notation.
10. Write the *sum* of the first hundred elements in $\mathbb{Z}^{>0}$ with the $\sum$ notation. (Aren't you glad this comes with the new notation?)
11. Rewrite the *sum* of the first five **squares** of elements in $\mathbb{Z}^{>0}$ with the $\sum$ notation.
12. Consider $s = \sum_{i=1}^{n} i$. *What* is the lowest value of $n$ for which $s \geq 40$? Explain how you approached the problem.
13. *Write* a Java `for` loop with the loop-control variable `j` that sums the first twelve *positive* integers into a variable named `sum`.
14. *Write* the same sum as the previous question using the $\sum$ notation.
15. Looking at the answers to the previous two questions, how are the two notations, Java and $\sum$, the same? How are they different? *Explain* what you need to be careful about when translating between the two notations.
16. Using what you know about Java `for` loops, what would you expect the sum $\sum_{i=5}^{6} i$ to be? What about $\sum_{i=6}^{6} i$? What about $\sum_{i=7}^{6} i$? Explain each of your answers.