**Your Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Names of classmates you worked with (if your WHOLE team worked together, write "Team")**

* name1
* etc.

**Instructions:**

* Complete all questions (there are **five** main tasks) using the website [sjspielman.shinyapps.io/evolforces](http://sjspielman.shinyapps.io/evolforces).
* As always, answer in your own words, and in a different color please.
* Be **BRIEF** with your answers! Each question can be answered with ~1 sentence or phrase, or if appropriate, one number!
* Please note: On the website output, for all simulations using Genetic Drift, the "before simulation" rows in the output tables will not appear. This makes it easier to only see RESULTS from simulations with less scrolling.

**TASK ONE**

Using the "Single Population" tab, examine how directional selection ALONE influences populations with the following simulation settings:

* Starting allele A frequency = 0.5
* AA fitness = 1.0
* Aa fitness = 0.85
* aa fitness = 0.7
* NO mutation, genetic drift turned OFF.
* Run for 500 generations.
* Did allele "A" fix and if so, at which generation?
* Why, under these simulation settings, does allele "A" fix and not allele "a"?
* What was the population heterozygosity before versus after simulation?
* Does directional selection tend to increase or decrease population variation?
* What was the population fitness before versus after simulation?
* Does directional selection tend to increase or decrease population fitness?

**TASK TWO**

Using the "Single Population" tab, examine how directional selection plus mutation influences populations with the following simulation settings. To achieve a robust comparison, we will keep most simulation parameters the same, but add in some mutation!

* Starting allele A frequency = 0.5
* AA fitness = 1.0
* Aa fitness = 0.85
* aa fitness = 0.7
* Mutation rate BOTH DIRECTIONS (A→ a AND a → A) both = 0.02
* Run for 500 generations.
* In this circumstance, allele "A" does NOT fix. What is the final allele A frequency?
* *Very briefly*, why does allele "A" not fix in this simulation?
* What is the final population heterozygosity?
* Compare the final heterozygosity to task one: Does mutation tend to increase or decrease variation based on this comparison?
* What is the final population fitness?
* Compare the final fitness to task one: Does mutation tend to *help* selection to increase fitness, or does mutation tend to *counter* selection's "efforts" to increase fitness?

**TASK THREE**

Using the "Single Population" tab, examine how genetic drift ALONE influences populations with the following simulation settings.

* Starting allele A frequency = 0.5
* All fitness = 1 (AA fitness = 1.0, Aa fitness = 1.0, aa fitness = 1.0)
* NO mutation
* Genetic drift turned ON with 20 replicates
* *Population size is 500*
* Run for 500 generations
* Based on GENOTYPE FITNESSES ALONE, do you expect that one allele will be favored over the other? Why or why not?
* In how many replicates did allele "A" fix? Of these replicates, what was the SHORTEST number of generations to fixation?
* In how many replicates did allele "a? fix? Of these replicates, what was the SHORTEST number of generations to fixation?
* In how many replicates did NEITHER allele fix?
* For the replicates where NEITHER allele fixed, what was the MAXIMUM heterozygosity? (Find the simulation replicate where this value is HIGHEST).
* Each simulation started with heterozygosity equal to 0.5. Generally speaking, does genetic drift tend to increase, decrease, or not affect variation?

**TASK FOUR**

Again using the "Single Population" tab, examine how genetic drift ALONE influences populations with the following simulation settings. But this time, we'll change the population size from Task Three to a SMALLER population:

* Starting allele A frequency = 0.5
* All fitness = 1 (AA fitness = 1.0, Aa fitness = 1.0, aa fitness = 1.0)
* NO mutation
* Genetic drift turned ON with 20 replicates
* *Population size is 25*
* Run for 500 generations
* In how many replicates did allele "A" fix? Of these replicates, what was the SHORTEST number of generations to fixation?
* In how many replicates did allele "a? fix?Of these replicates, what was the SHORTEST number of generations to fixation?
* In how many replicates did NEITHER allele fix?
* For the replicates where NEITHER allele fixed, what was the MAXIMUM heterozygosity? (Find the simulation replicate where this value is HIGHEST). If this never happened, write "N/A" for your answer.
* Compare results from Task Three (N=100) to this Task Four (N=25). For any fixation that occured, *generally speaking* did fixation happen SOONER or LATER for N=25 compared to N=100?
* Consider your last answer: Is genetic drift therefore stronger in smaller (N=25) or larger (N=500) populations?

**TASK FIVE**

Using the "Single Population" tab, examine how genetic drift AND selection together influence population. You will do three different simulations here. All simulations will have these settings in common. These match Task One. Therefore, Task Five allows you to directly see what drift does to selection!

* Starting allele A frequency = 0.5
* AA fitness = 1.0; Aa fitness = 0.85; aa fitness = 0.7
* NO mutation
* Genetic drift turned ON with 20 replicates
* Run for 500 generations
* Set the population size to **1000** (don't use a comma!!). Of the 20 replicates…
  + In how many replicates does "A" fix?
  + In how many replicates does "a" fix?
  + In how many replicates does neither allele fix?
  + In this circumstance, was drift or selection stronger? (Hint: If drift is stronger, most replicates will look VERY DIFFERENT from Task One in terms of allele fixation. If selection is stronger, most replicates will look VERY SIMILAR to Task One in terms of allele fixation. Recall the number of generations to fixation in Task One to help you!!)
* Set the population size to **100**. Of the 20 replicates…
  + In how many replicates does "A" fix?
  + In how many replicates does "a" fix?
  + In how many replicates does neither allele fix?
  + In this circumstance, was drift or selection stronger?
* Set the population size to **10**. Of the 20 replicates…
  + In how many replicates does "A" fix?
  + In how many replicates does "a" fix?
  + In how many replicates does neither allele fix?
  + In this circumstance, was drift or selection stronger?