Homework 1 Answers

**Problem 1: TRUE/FALSE**

1. FALSE: Stochastic models will not always produce the same output x given the same input parameters 0. Rather unlike deterministic models, where outcomes are fully determined by the input parameters and initial conditions, stochastic models produce a range of possible outcomes, each with a certain probability.
2. FALSE: Replicability refers to obtaining consistent results by conducting a new study with different data under similar conditions. While reproducibility refers to obtaining consistent results using the same data and analysis methods.
3. TRUE
4. FALSE: IT can squash multiply commits into one. It also takes the commits from one branch and applies them on top of another branch.
5. TRUE: A detach head typically means that your HEAD pointer is not point to a specific branch, but a specific commit. This is usually the case when you are trying to find specific commits of your work.
6. TRUE
7. FALSE: It checks object identity. It determines if the objects are the same, not if they are equal.
8. FALSE: While the .gitignore file will specify files to ignore, the user can override it using certain commands such as git add -f

**Problem 2: Inverse vs. Forward Problems**

A forward problem is a situation where you know the input parameters and you want to compute the output. In contrast an inverse problem is reversing the process. It is where you are given the output, and you need to determine the input.

**Forward problem 1:** Epidemiology (COVID Spread)

Given the current number of infected individuals, the infection rate, and recovery rate, calculate the total number of infected people over time using the SIER model.

**Difficulty:** Low to moderate as we have the SEIR model.

**Forward problem 2:** Pred-prey

Given the birth rate of prey and the rate at which predators consume prey, predict the future population sizes of both predator and prey using models.

**Difficulty:** Low to moderate. Solvable through differential equations.

**Forward problem 3:** Vehicle Emissions:

Given the emission rate per new vehicle, the rate of new vehicle purchases, and the rate at which old vehicles are retired, predict future emissions released into the atmosphere over a specified period.

**Difficulty:** Low because you can map generally linear relationships based on easily available data.

**Reverse problem 1:** Epidemiology (COVID Spread)

From observed data on the total number of infected individuals over time, infer the infection rate and recovery rate.

**Difficulty:** Moderate to high due to the inference required.

**Reverse problem 2:** Pred-prey

From observed predator and prey population sizes over time. infer the birth rate of prey and the consumption rate of predators.

**Difficulty:** Hard because it’s hard to infer what the causes of changing predator and prey ratios could be caused by. It could be due to the environment or human interaction. Ecosystems are very complex and interlinked.

**Reverse problem 3:** From historical data on total emissions, infer the emission rate per vehicle and the rates of new vehicle purchases and retirements.

**Difficulty:** Moderate difficulty as there are less parameters to include. Generally, the number of vehicles that exist and the ratio of new to old vehicles is more than enough to determine a relatively close emission output for new versus old vehicles.

Generally forward problems are easier to solve since they involve applying know equations, models, and data to find a solution. On the other hand,

Dealing with inverse problems is much more difficult as some information has been lost. There is more intuition required to determine the cause rather than the effect.

**Problem 3: Git and GitHub**

* 1. Created public GitHub repo
  2. Created enivironment.yml file
  3. Created Logo
  4. Created readme
  5. Created Updated readme with proper brief and logo formatted

1. **Part 2**
   1. Created merge conflict
2. **Part 3**

**git restore:** Restores changes in your working directory or staging area. It is commonly used to restore files to a specific state.

**git checkout:** allows you to checkout branches that is a copy of what is currently on the main branch. This allows you to make changes and add new code so that you can merge those changes back into the main branch. Extremely useful if you are working with people that are working on different non-related features.

**git reset:** It is a great tool that allows you to undo commits and move the head pointer. This allows you to discard changes in your working directory

**git revert:** It is used to undo a commit by creating a new commit.

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| --- | --- | --- | --- | --- |
| **Command** | **Affects Commit History?** | **Affects Staging**  **Area?** | **Affects Working Directory?** | **Typical Use Case** |
| git reset | Yes | Yes | Optional | Undo changes by moving the Head pointer and optionally modify the staging area and/or working directory. |
| git restore | No | Optional | Yes | Restore files in the working directory or staging area to their state in a specific commit or branch. |
| git rm | Yes | Yes | Yes | Remove file from the working directory and staging area, and mark them for deletion in the next commit |