

# In-Class Problem Set: Distributions, Q-Q Plots, and Faceting (R + GitHub)

**Goal.** Use real conflict data to practice diagnosing distributional shape using histograms, density plots, and Q-Q plots, including comparisons across groups using faceting. You will pull the data from GitHub, build a reproducible workflow, generate required plots, interpret what they show, and submit via GitHub.

**Dataset.** `battle_deaths` (1141 rows; 6 variables):

- `iso2c` (country code), `country`, `year`
- `battle_deaths` (numeric; battle-related deaths)
- `region` (categorical), `income` (categorical)

**What to submit (in your GitHub repo).**

- A script file: `scripts/lab.R`
- A short write-up: `outputs/writeup.md`
- Saved figures in `figures/` (see requirements below)

**Rules.**

- Work inside an **R Project**.
- Use a **sequential, hard-coded workflow** (no user-defined functions).
- Save figures using `ggsave()` (no screenshots).
- Git commands must be run in the **Terminal tab**, not the R Console.
- Unless your lecture explicitly did otherwise, treat missing values defensibly (state what you did).

## Questions

### 1. Pull the data and set up your workflow (proof required).

(a) In the **Terminal tab**, run:

```
git status
git pull
```

(b) Confirm the dataset file exists in your repo (path posted in the course repository).

(c) Create the standard folder structure (if missing): `scripts/`, `outputs/`, `figures/`.

(d) **Proof (write-up):** In `outputs/writeup.md`, paste:

- the output of `getwd()`,
- the output of `list.files()` from the project root, and
- the output of `list.files("data")` showing the dataset file.

### 2. Load and summarize `battle_deaths`.

(a) Load the dataset into an object named `df`.

(b) Verify the six key columns exist: `country`, `year`, `battle_deaths`, `region`, `income`.

- (c) Summarize the distribution of `battle_deaths` (min/median/mean/max is sufficient).
- (d) **Proof (write-up):** Report:
- number of rows and columns,
  - the number of unique countries,
  - the range of years,
  - a short summary of `battle_deaths`.

### 3. Histogram of battle deaths (baseline).

Create a histogram of `battle_deaths`.

- You must make a clear binning choice and state it (binwidth or number of bins).
- If you restrict the x-axis (e.g., to reduce the influence of extreme values), you must state the rule you used.

Save as:

`figures/battle_deaths_hist.png`

### 4. Density plot of battle deaths (baseline).

Create a density plot of `battle_deaths`.

- Use the same x-axis limits as your histogram (so the two are comparable).
- Label the axes clearly.

Save as:

`figures/battle_deaths_density.png`

### 5. Q–Q plot (normality check).

Create a Q–Q plot comparing `battle_deaths` to a theoretical normal distribution.

- Include a Q–Q reference line.
- In your write-up, describe what kind of deviation you see (e.g., heavy right tail, skew).

Save as:

`figures/battle_deaths_qq.png`

### 6. Faceting by income and region (required).

Create two sets of faceted distribution plots:

- (a) A faceted plot by **income**
- (b) A faceted plot by **region**

For each set, choose **one** distribution geometry that was covered in lecture (histogram or density) and facet it. Your goal is to compare how distributional shape differs across groups.

**Required:**

- Use consistent axis limits across facets (so comparisons are meaningful).
- If some facets are too sparse to interpret, state what you did (e.g., dropped very small groups, or noted limitations).

Save as:

- `figures/facet_income.png`
- `figures/facet_region.png`

### 7. Interpretation (write-up required).

In `outputs/writeup.md`, write 12–16 sentences addressing:

- What do the histogram and density plot suggest about skew and tail behavior?
- What does the Q–Q plot reveal (and why is it useful here)?
- Compare distributions by income: what differences (if any) stand out?
- Compare distributions by region: what differences (if any) stand out?
- Name one concrete plotting choice you made (bins, limits, faceting) and why it helped interpretability.

## 8. Push your work to GitHub (proof required).

(a) In the **Terminal tab**, run:

```
git status
git add .
git commit -m "Distributions lab: battle_deaths faceting + QQ"
git push
```

(b) **Proof (write-up):** Paste:

- the output of `git status` after committing (clean working tree), and
- the output of `git log -1`.

## Optional challenge (if you finish early): ggridges

Create a ridgeline density plot using `ggridges` for `battle_deaths` grouped by **income** *or* **region**.

- Save as `figures/ridgeline.png`.
- In 4–6 sentences, explain what the ridgeline plot makes easier (or harder) to compare relative to faceting.

## Checklist (before you leave)

- `scripts/lab.R` runs top-to-bottom
- Required figures exist in `figures/`:
  - `battle_deaths_hist.png`, `battle_deaths_density.png`, `battle_deaths_qq.png`
  - `facet_income.png`, `facet_region.png`
- `outputs/writeup.md` includes interpretation + proofs
- Work is committed and pushed to GitHub