

1. Voting in the 2025 Eurovision Song Contest (60 %)

The Eurovision Song Contest is a televised contest that has been taking place annually since the late 1950s. Today, most European and a few other countries participate. Each participant sends an artist with a song to a show organized by last year's winner, and the competition is over who has the best song. The winner is decided by a vote, where two groups in each country have a say: A jury, consisting of supposed specialists in music, and a televoting scheme where television viewers vote over their preferred song. Each country then submits points in each category, points being in the range 1-8, 10 and 12.

The file `esc.csv` contains the points awarded by the jury in the 2025 contest. The variable `contestant` is the name of the country receiving points, `total_score`, `jury_score`, and `televote_score` is the total number of points received by the country, and the remaining variables the names of the countries awarding the points.

a)

Read the csv file `esc.csv` into a tibble. What is the number of countries participating in the final and hence receiving points, and what is the number of participants awarding points?

Note: Some countries are cancelled in qualifying rounds, hence the two numbers are not equal.

b)

Transform the data into a long format, where each line has variables `contestant`, `awarding`, and `score` for the number of points awarded by “awarding” to “contestant”. Replace the missing values (NA) with 0s.

c)

Use the tibble constructed above to compute the number of top scores (12) received by each contestant. Plot this number against the total jury score, indicating the country name for each contestant. Make sure to label the axes properly.

d)

One could suspect that countries trade points, so say Norway awards Sweden many points in return for Sweden also awarding Norway many points. To test this, we want to extend the long tibble constructed under b) with a new variable `score_reverse` containing the

number of points going in the opposite direction. Include this variable, and inspect in a graph the relationship between the two scores. What is the relationship between the two?

Hint: To construct the variable `reverse_score`, you may need to construct a new tibble with reversed sending and receiving country and join this tibble back.

e)

Next we want to compare the points awarded by the jury and by the television viewers. The Excel file [esc.xlsx](#) contains both the jury votes and the viewer votes, the latter in the sheet “Televote”. Import the data from this sheet and clean the data to a similar structure as the file used in question b).

Hint: It may be easiest to first import the data as used in question a) and then repeat the reshaping to a long format.

f)

Join the two voting tibbles together. Compute the absolute value of the difference between the jury and viewer votes. What are the 5 contestants with the highest average difference?

2. Integration (25 %)

a)

We want to compute the integral

$$I = \int_0^1 \frac{x-1}{\ln x} dx$$

Use Monte Carlo integration with 1000 draws to compute the value.

b)

One can show that $I = \ln 2 \approx 0.693$. Let I_n be the approximation to the integral using Monte Carlo integration with n draws. Compute I_n for $n = 10, 100, 1000, 10\,000$, and $100\,000$. Show the approximation error against n in a graph, taking logs if necessary to make the graph easy to read. Explain what we can read from the graph and give the theoretical rationale for this pattern.

c)

A consumer has a so-called CRRA utility function

$$u(c) = \frac{c^{1-\sigma} - 1}{1-\sigma}$$

with relative risk aversion $\sigma = 2$. Her consumption $c = b + e$ is stochastic, and is a sum of a fixed term $b = 5$ and a stochastic component e with a log normal distribution so

$$\ln e \sim N(0,1).$$

Use Monte Carlo integration to find the expected utility $Eu(c)$ of the consumer.

3. Text encoding (15 %)

Explain how text has traditionally been stored in binary format using the ASCII encoding, and explain the shortcomings of this approach. Go on to explain the UTF8 format, how it relates to ASCII, and how it solves the problems associated with ASCII. How does UTF8 relate to Unicode? Do you see any shortcomings or weaknesses with UTF8?