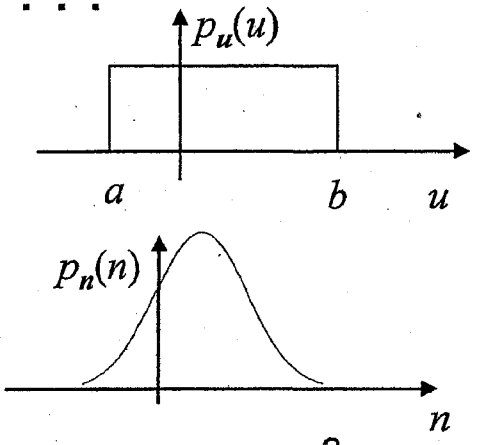
How to generate a population density map?

- Given: population density $d(\theta,\varphi)$ in people per km^2
  where θ – longitude [0 . . . 360 degree]
  φ – latitude [-90 . . . 90 degree]

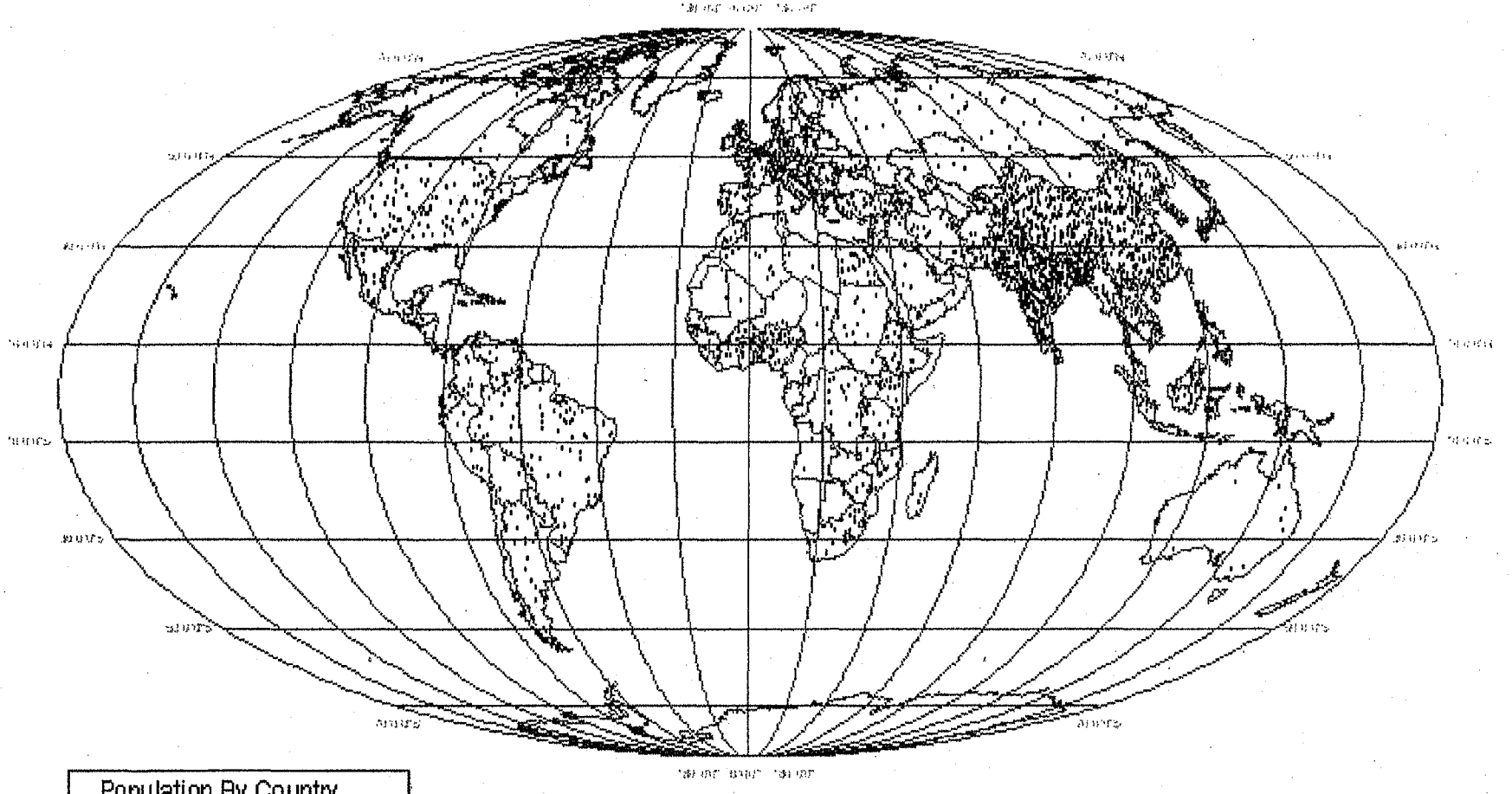
- **Devise an algorithm that generates random number pairs (θ,φ) in accordance with the population density $d(\theta,\varphi)$**

- You can generate random numbers by using . . .
  - . . . a function $u(a,b)$ that generates random numbers uniformly distributed between a and b
  - . . . a function $n(\mu,\sigma)$ that generates Gaussian random numbers with mean μ and variance σ^2



Bernd Girod

World Population Density - 1994

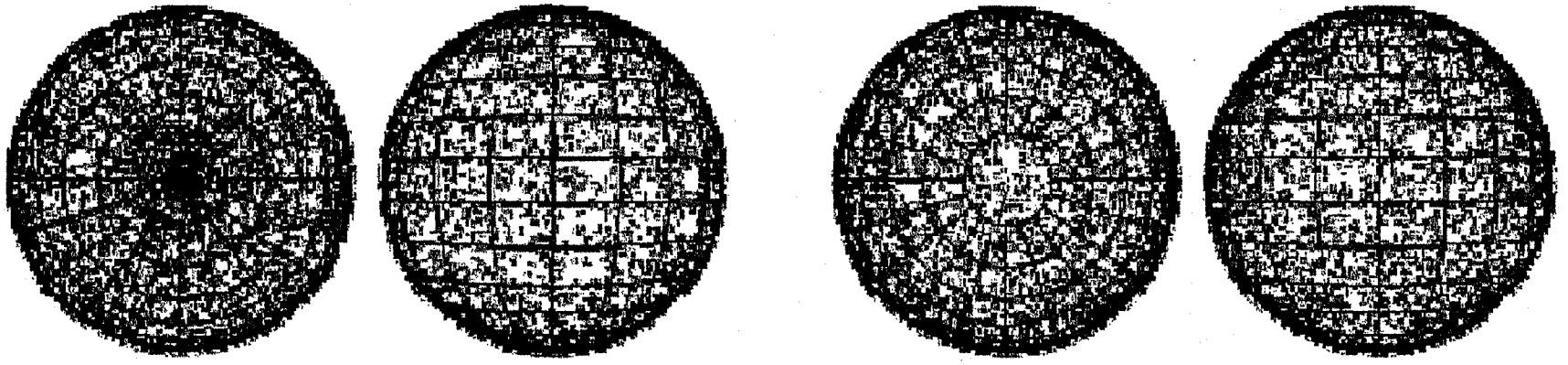


Population By Country

1 Dot = 2,000,000 people

Mapmaker: Mitzi Comstock
Date Created: April 13, 2005
Source: ESRI, 1994
Projection: Mollweide

top view side view top view side view



incorrectly distributed points correctly distributed points

Prof. Girod

Birds independently land on an infinitely long telegraph wire at random positions. Each bird has a right neigbor and a left neighbor. The distance Δ between neighboring birds is exponentially distributed according to the pdf $f_\Delta(\Delta) = e^{-\Delta}$ for $\Delta \geq 0$.

(a) What is the pdf of the distance between a bird and its nearest neighbor?

(b) If bird B' is the nearest neighbor of B, what is the probability that B is also the nearest neighbor of B'?

(c) Paint the interval between B and its nearest neighbor B' yellow. If we do this for each bird B, what fraction of the real line will be painted yellow?

You are giving N = 2 identical fuses. Their rating is the same; it is one of the following values:

0.5 mA, 1 mA, 2 mA, 5 mA, 10 mA, 20 mA, 50 mA, 100 mA, 200 mA, 500 mA, 1 A

Since the fuses are not marked, you test them repeatedly with different currents to determine the unknown rating. When the current exceeds the rating, the fuse is irreversibly destroyed.

Devise a strategy that minimizes the maximum number of tests to reliably determine the fuses' current rating.

How many tests T are required to distinguish R different ratings, if you have N fuses?

Note: All N fuses may be destroyed in the process.