Charts of probability points for Roy's Test

Statistics 5401 October 17, 2005

On the following pages are charts that allow you (a) to get critical values for $\hat{\theta}_1 = \dfrac{\hat{\lambda}_1}{1+\hat{\lambda}_1}$, where $\hat{\lambda}_1$ is the largest eigenvalue of **H** relative to **E** (largest eigenvalue of $\mathbf{E}^{-1}\mathbf{H}$), and (b) to test the significance of observed $\hat{\lambda}_1$.

Each chart goes with one value of $s = \min(p, f_h)$ for a particular value of α. There are charts for s = 2, 3, 4 and 5 and α = .05, .025 and .01.

Each chart contains graphs that are effectively double the width of the chart, with the curves at the lower left continuing (with a little overlap) the curves starting at the upper left.

The two scales below the X-axis represent values of $\hat{\theta}_1$. The upper scale, from 0 to .550 goes with the upper set of curves; the lower scale, from .500 to 1, goes with the lower curve.

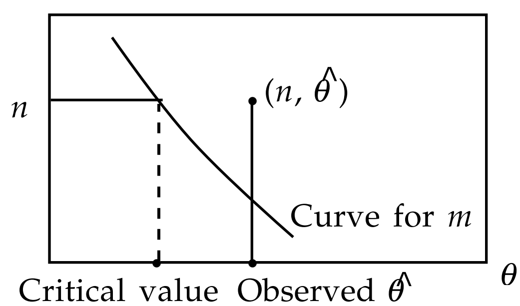
Each curve goes with one value of $m = -1/2, 0, 1, 2, 3, \ldots, 10$, where $m = (|p - f_h| - 1)/2$. Note that the two bottom curves in each group are for $m = -1/2$ and $m = 0$ while the remaining curves are for $m = 1, 2, \ldots, 10$ *stepping by 1*. For intermediate values like $m = 5/2$ you need to interpolate between the curves for $m = 2$ and $m = 3$.

The Y-axis represents n from 5 to 1000.

Usage:

(a) To find a critical value:

Find where the curve for m crosses the horizontal line corresponding to n. The horizontal position of the intersection is the critical value $\hat{\theta}_{1,\alpha}$ for $\hat{\theta}_1 = \hat{\lambda}_1/(1+\hat{\lambda}_1)$.



You can compute a critical value $\hat{\lambda}_{1,\alpha}$ for $\hat{\lambda}_1$ as $\hat{\lambda}_{1,\alpha} = \dfrac{\hat{\theta}_{1,\alpha}}{1-\hat{\theta}_{1,\alpha}}$.

(b) To test significance of observed $\hat{\lambda}_1$.

Compute $\hat{\theta}_1 = \hat{\lambda}_1/(1+\hat{\lambda}_1)$, s, m and n.

On chart for s, if point $(\hat{\theta}_1, n)$ is above line for m, reject H_0; otherwise you cannot reject. In the sketch, $\hat{\theta}_1$ is significantly large.

The charts are from Heck, D.L. Charts of Some Upper Percentage Points of the Distribution of the Largest Characteristic Root, *Ann.Math.Statist.* **31** (1960) 625-642.

Chart I, s = 2,α = .01

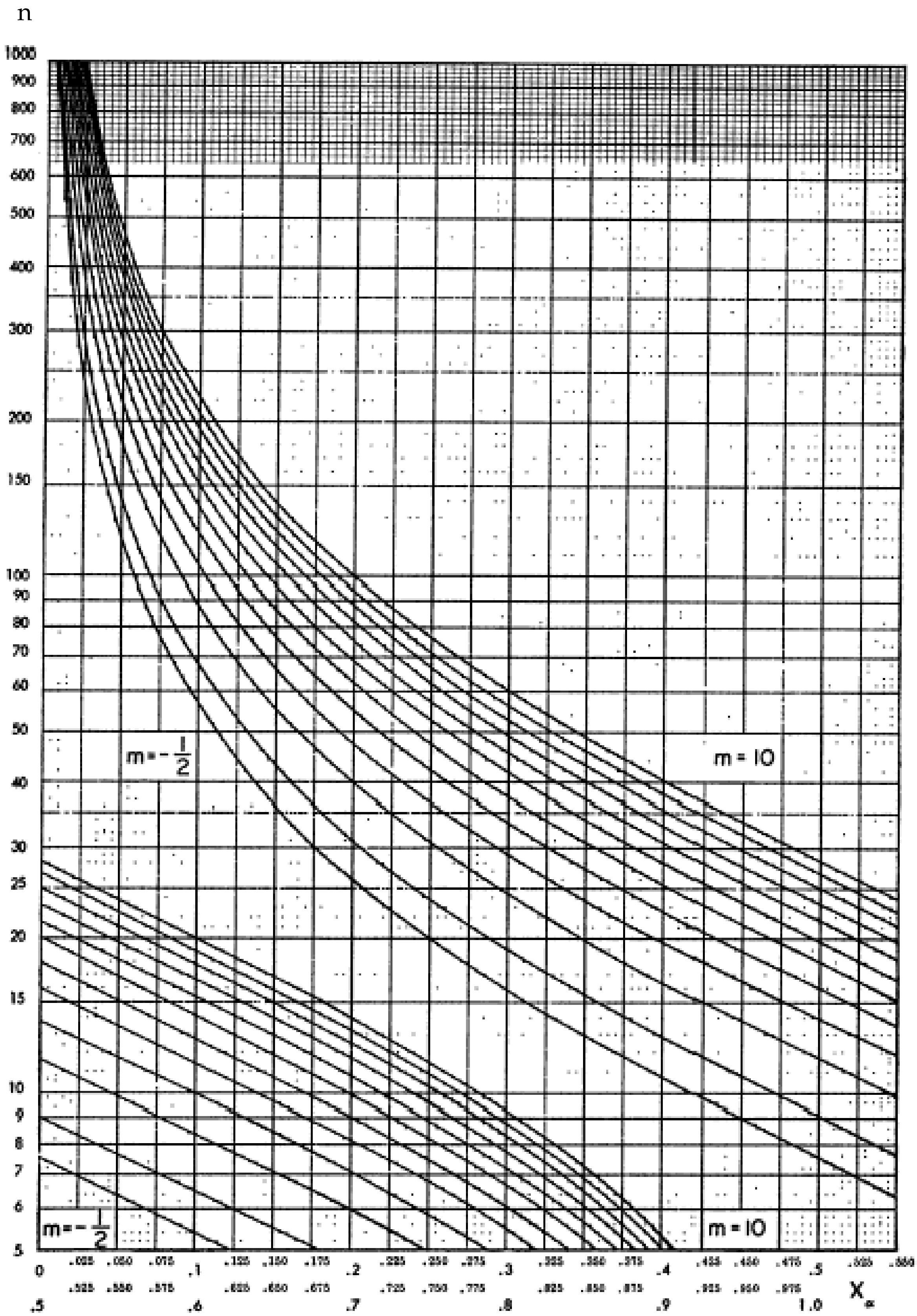


Chart II, s = 2,α = .025

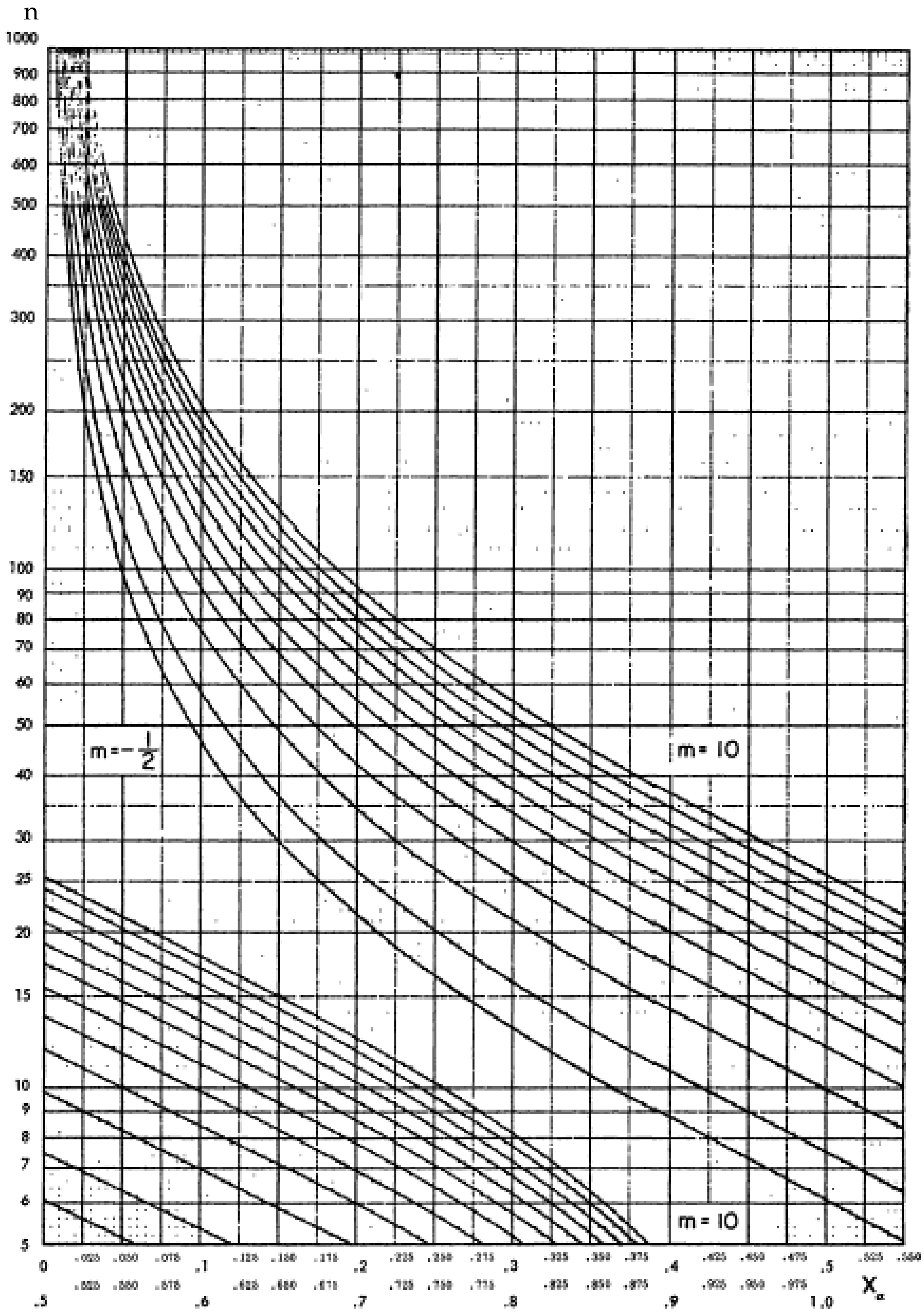


Chart III, s = 2,α = .05

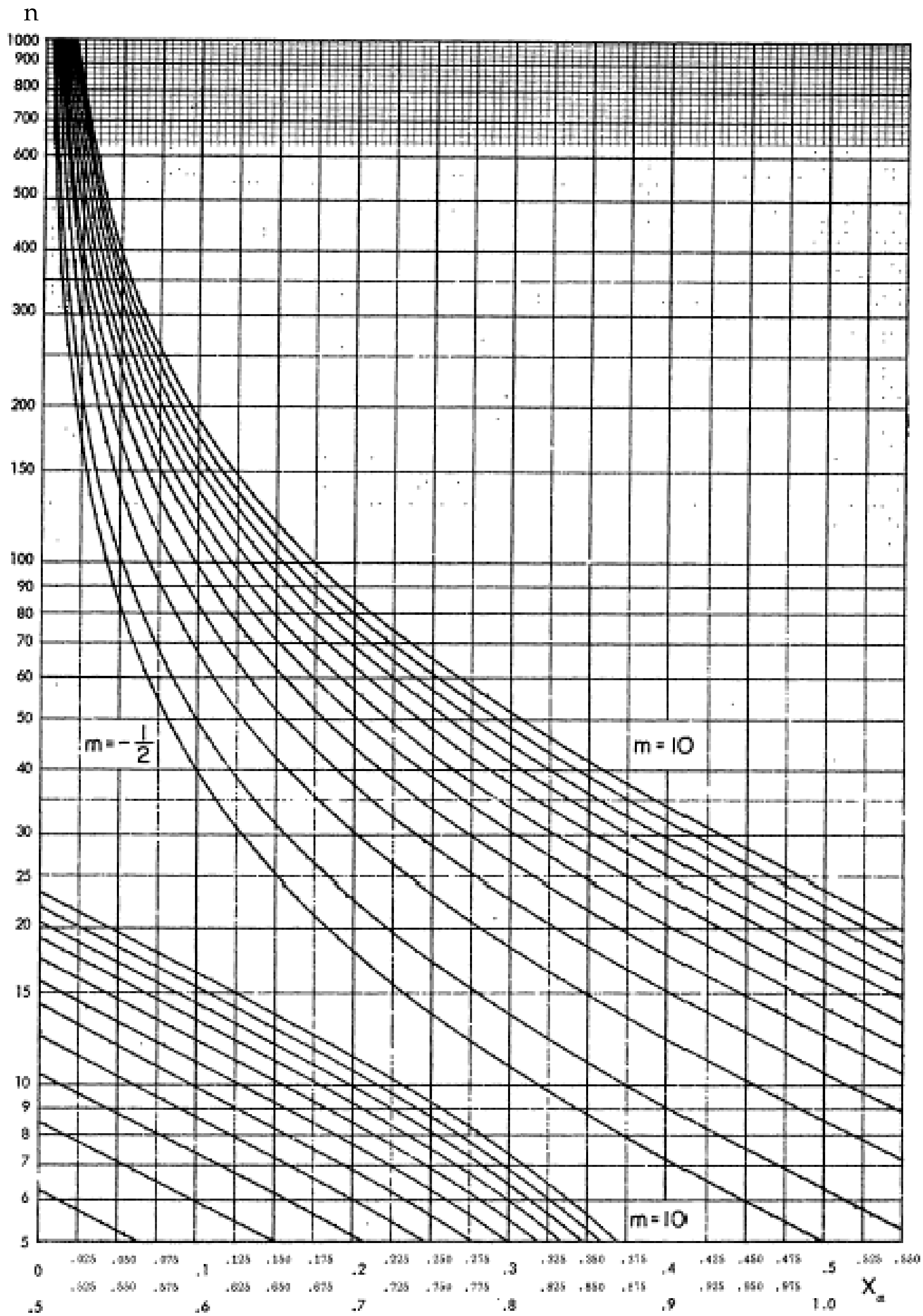


Chart IV, s = 3, α = .01

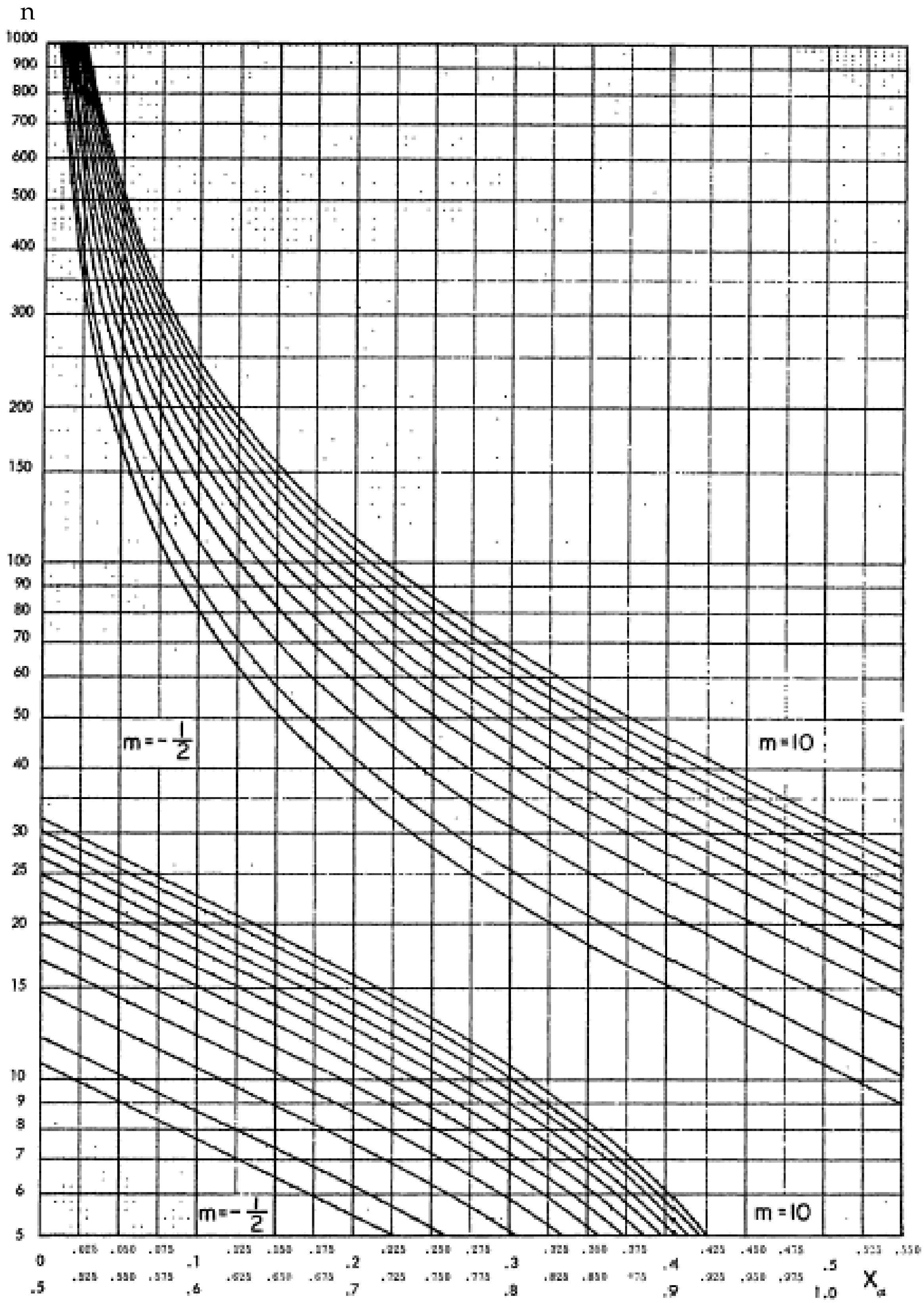


Chart V, s = 3,α = .025

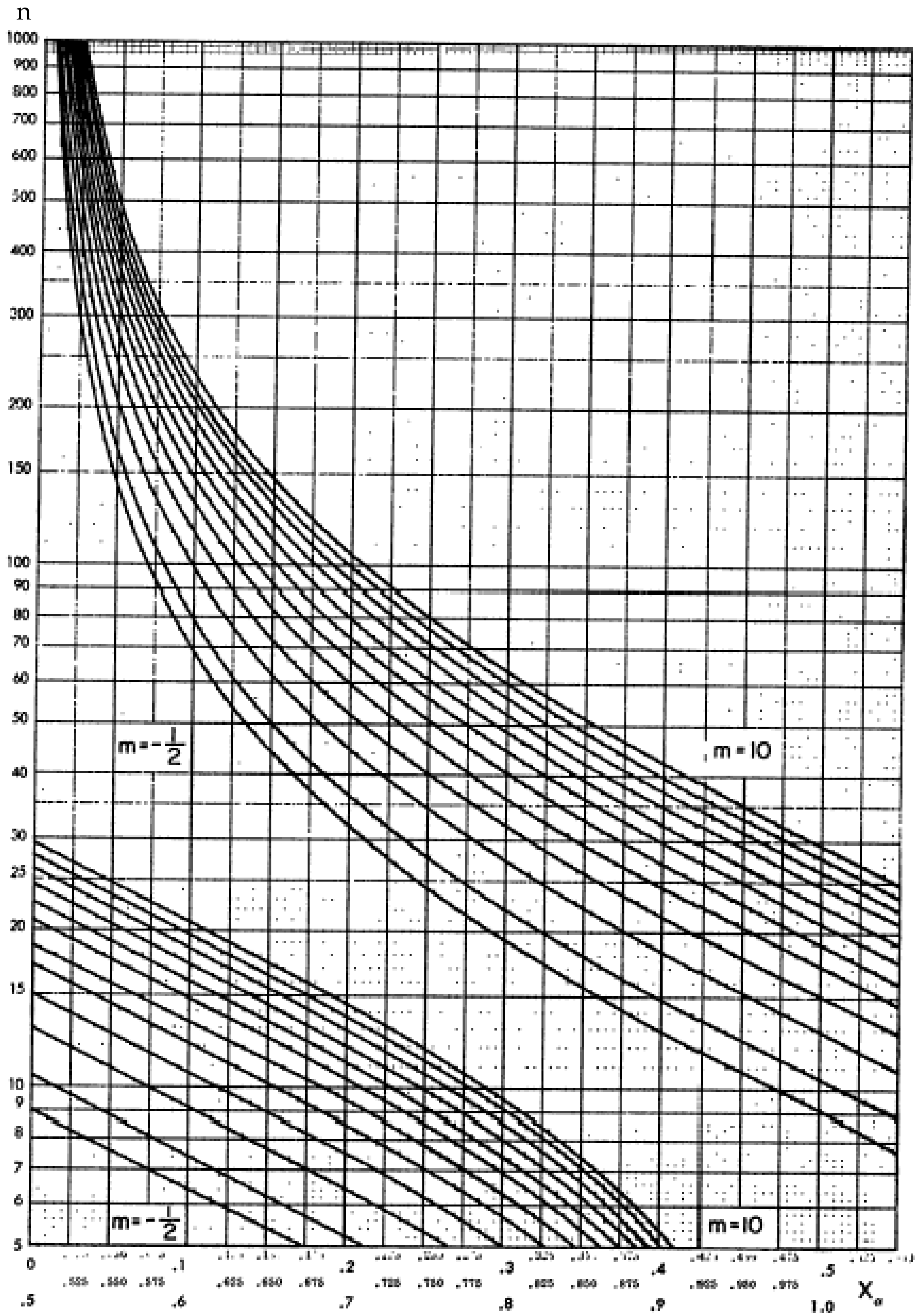


Chart VI, s = 3,α = .05

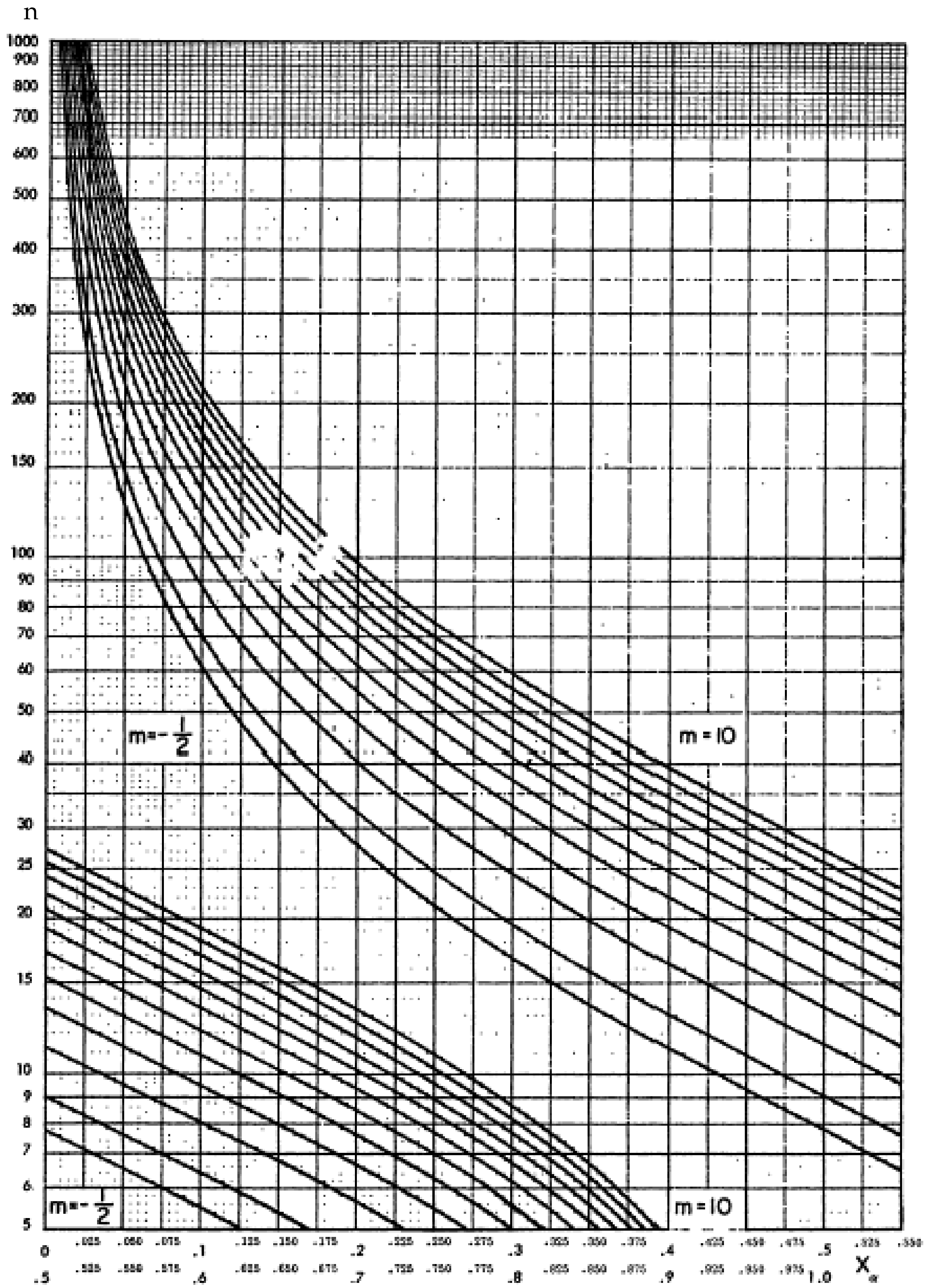


Chart VII, s = 4,α = .01

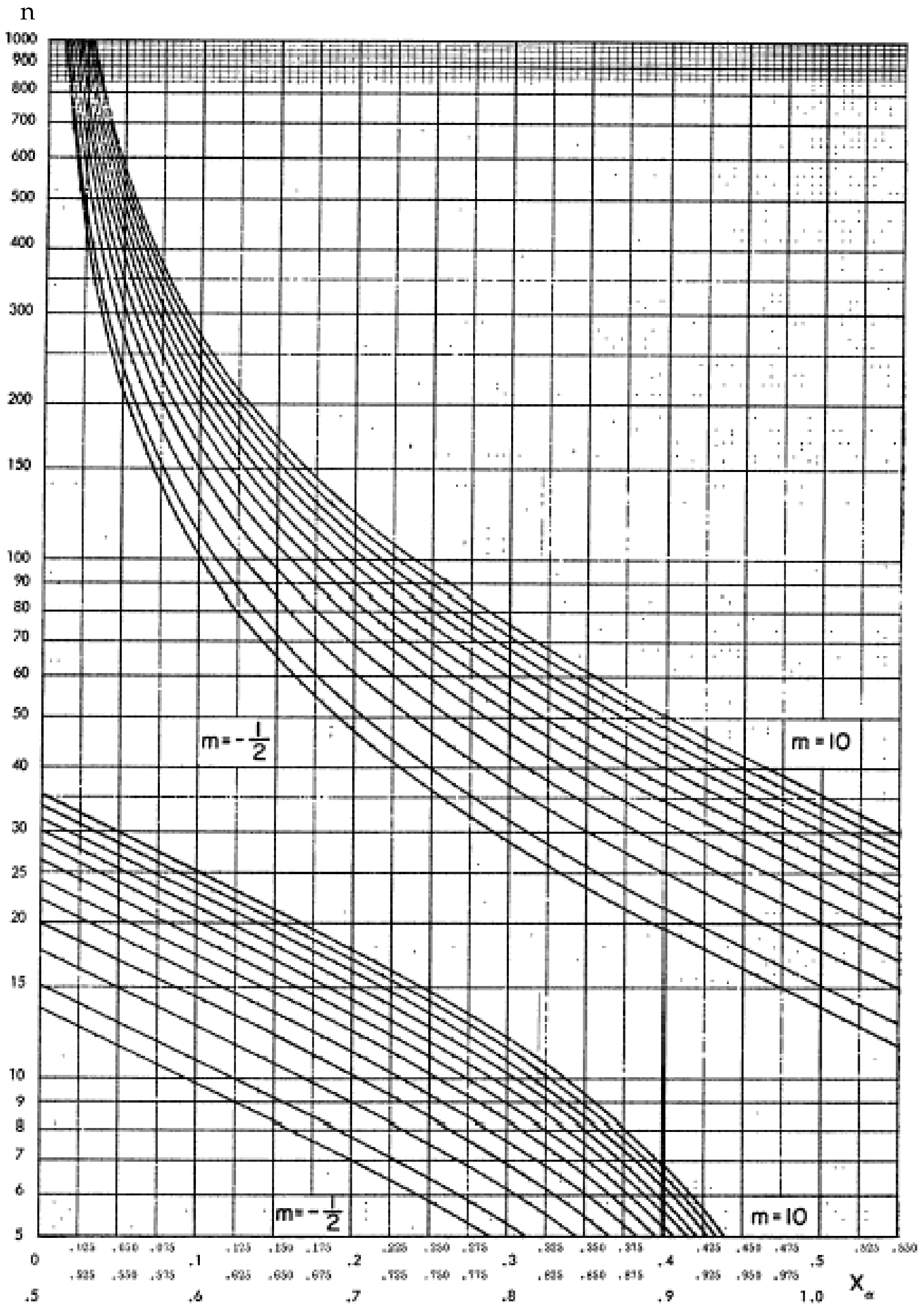


Chart VIII, s = 4,α = .025

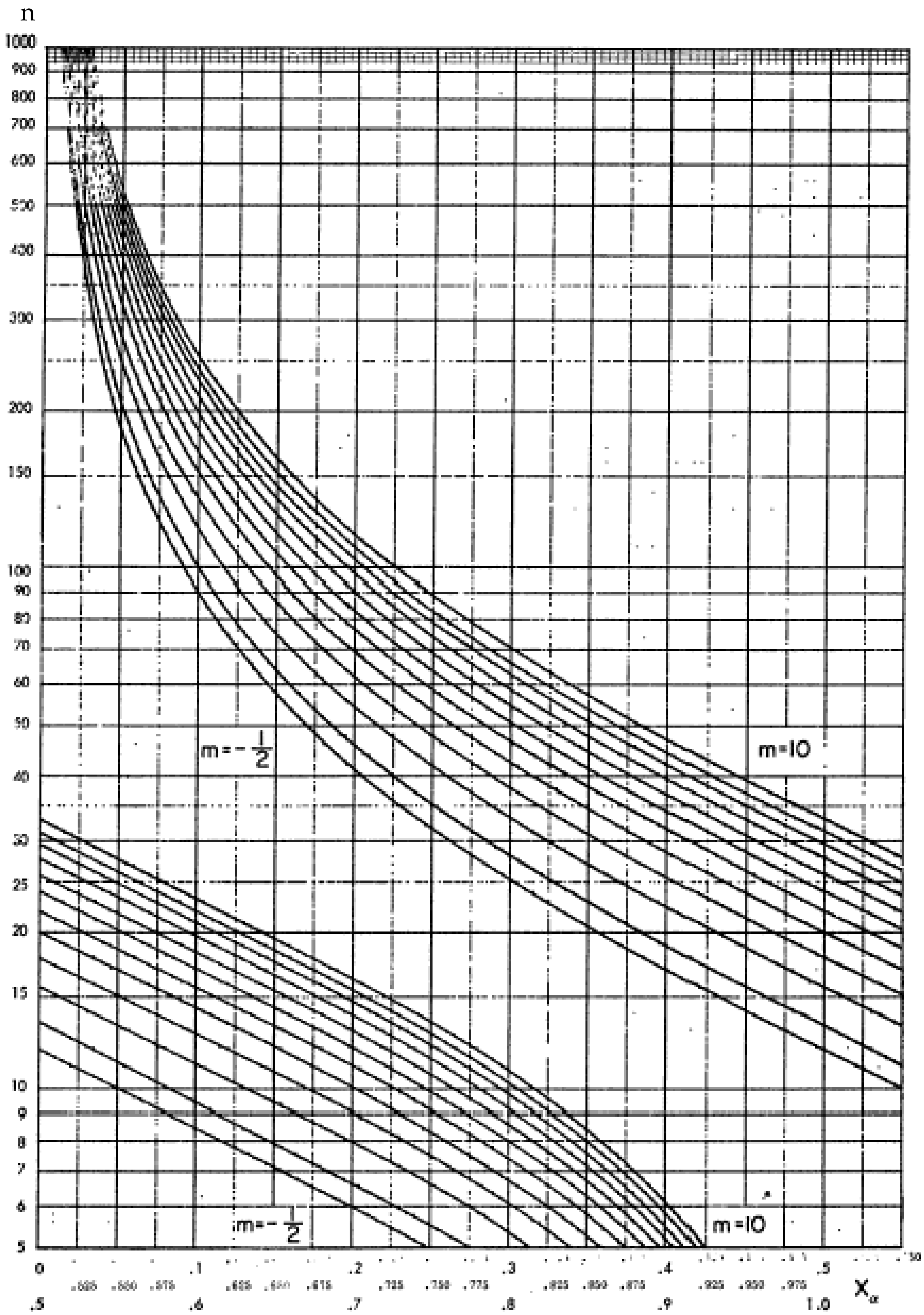


Chart IX, s = 4,α = .05

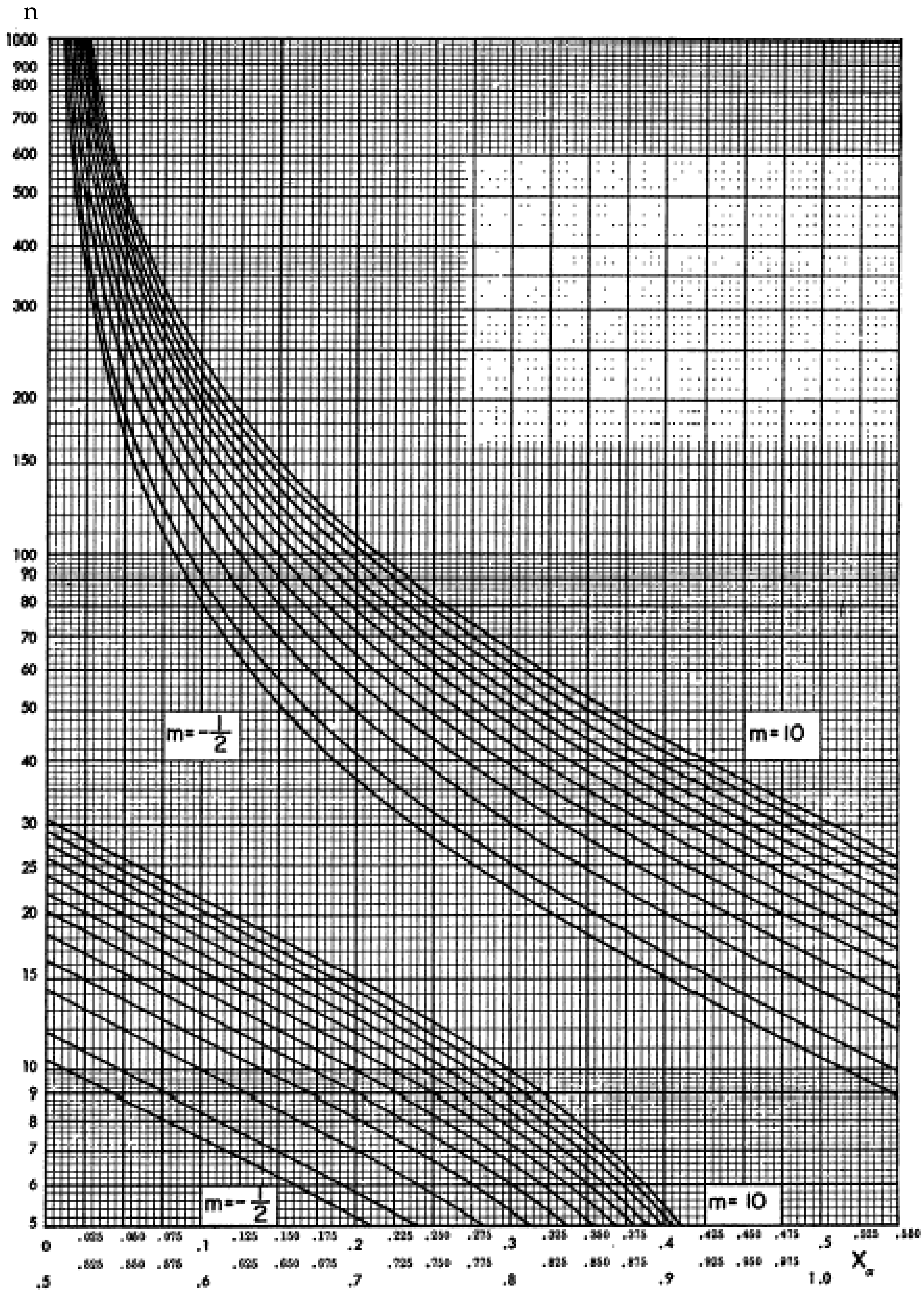


Chart X, s = 5,α = .01

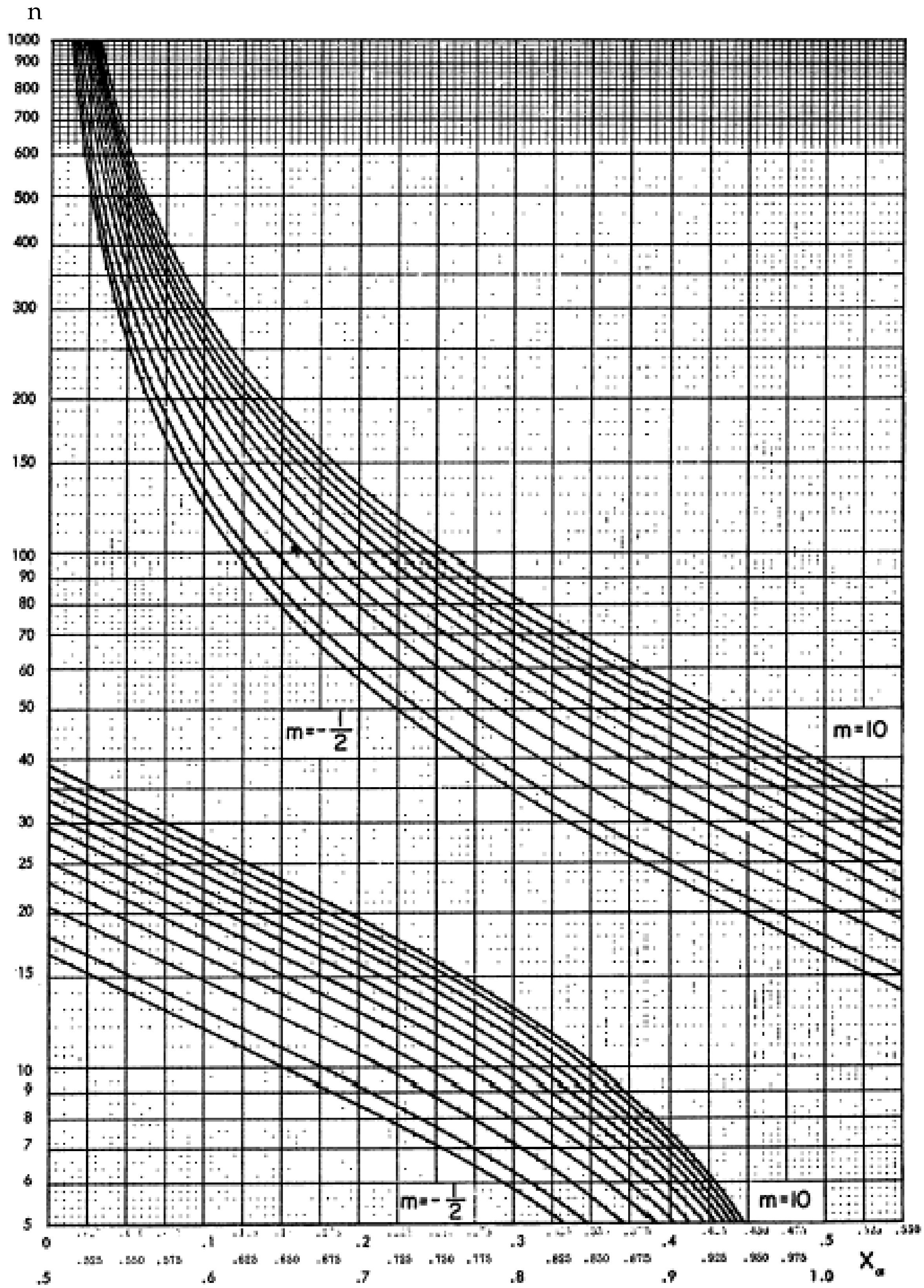


Chart XI, s = 5,α = .025

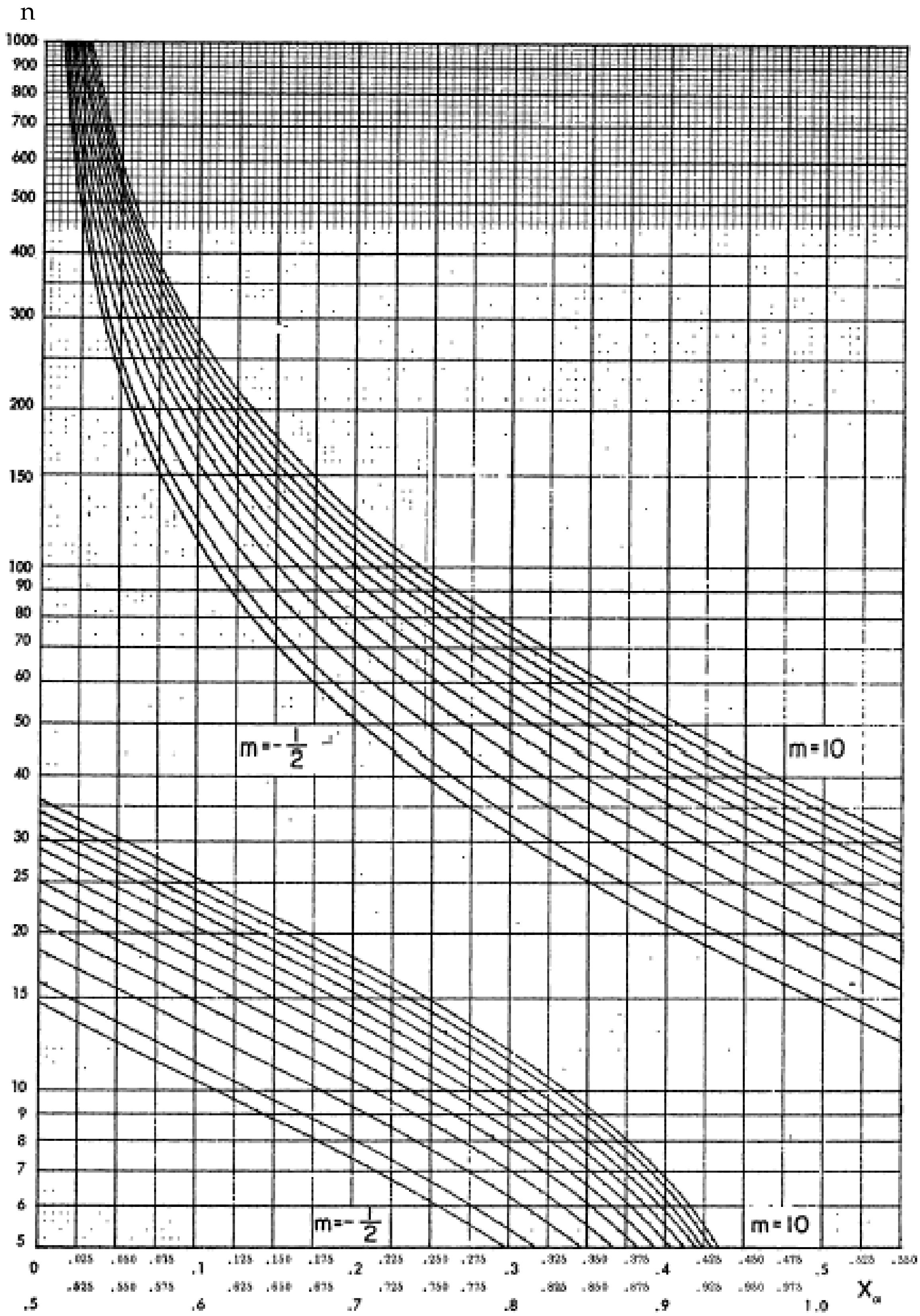


Chart XII, s = 5,α = .05