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(a) for $\theta \leq 1.5$,

$$\pi(\theta) = 1$$

otherwise

$$\pi(\theta) = (\frac{1.5}{\theta})^n$$

(b)

$$\alpha = max_{\Omega_0}\pi(\theta) = (\frac{3}{4})^n$$

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(a)

$$\begin{aligned}
\pi(0) &= 1 \\
\pi(.1) &= .3941 \\
\pi(.2) &= .1558 \\
\pi(.3) &= .3996 \\
\pi(.4) &= .7505 \\
\pi(.5) &= .9423 \\
\pi(.6) &= .9935 \\
\pi(.7) &= .9998 \\
\pi(.8) &= 1 \\
\pi(.9) &= 1 \\
\pi(1) &= 1
\end{aligned}$$

(b)

$$\alpha = \pi(.2) = .1558$$

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accept H_0 when $|\bar{X}_n - \mu_0| < c$.

$$\begin{aligned}
0.05 = \alpha &= P(|\bar{X}_n - \mu_0| \geq c) \\
&= P(|Z| \geq 5c) \\
&= 2(1 - \Phi(5c)) \\
c &= \frac{1.96}{5} = 0.392
\end{aligned}$$

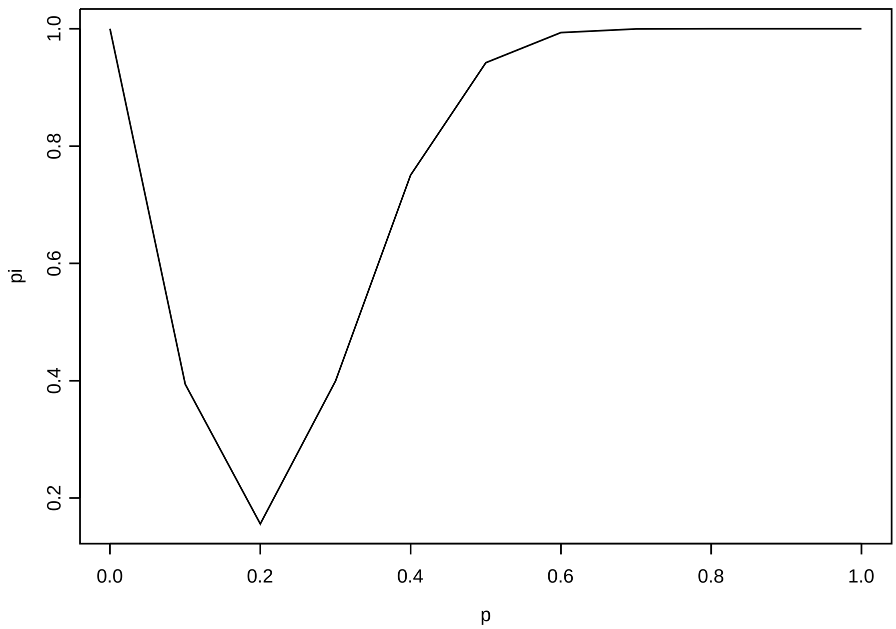

Figure 1: The plot of pi

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$$P(f_0|x) = \frac{(\frac{2}{3})1}{(\frac{2}{3})1 + (\frac{1}{3})4x^3} = \frac{1}{1+2x^3}$$

Expected loss if we guess f_0:

$$0 \cdot \frac{1}{1+2x^3} + 4 \cdot \frac{2x^3}{1+2x^3} = \frac{8x^3}{1+2x^3}$$

Expected loss if we guess f_1:

$$1 \cdot \frac{1}{1+2x^3} + 0 \cdot \frac{2x^3}{1+2x^3} = \frac{1}{1+2x^3}$$

So we guess f_0 if

$$\frac{8x^3}{1+2x^3} \leq \frac{1}{1+2x^3}$$
$$0 < x \leq \frac{1}{2}$$

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$$P(minor|x) = \frac{(.8)3^{\sum X_j} e^{-3n}}{(.8)3^{\sum X_j} e^{-3n} + (.2)7^{\sum X_j} e^{-7n}}$$
$$= \frac{(4)3^{\sum X_j}}{(4)3^{\sum X_j} + 7^{\sum X_j} e^{-4n}}$$

Expected loss if we guess minor:

$$2500\frac{7^{\sum X_j}e^{-4n}}{(4)3^{\sum X_j}+7^{\sum X_j}e^{-4n}}$$

Expected loss if we guess major:

$$400\frac{(4)3^{\sum X_j}}{(4)3^{\sum X_j}+7^{\sum X_j}e^{-4n}}$$

We choose minor if

$$\begin{aligned}2500\cdot 7^{\sum X_j}e^{-4n} &\leq 1600\cdot 3^{\sum X_j}\\ \sum X_j \leq \frac{log(\frac{25}{16})-4n}{log(\frac{3}{7})}\end{aligned}$$

Problem 3

(a)

$$\begin{aligned}P(\theta=1|x) &= \frac{e^{-n}}{e^{-n}+e^{-4n}4^{\sum X_j}}\\ &= \frac{1}{1+4^{\sum X_j}e^{-3}}\end{aligned}$$

(b)

$$\begin{aligned}L_x(\theta) &\propto e^{-5\theta}\theta^{24}\\ r(x) &= \frac{L_x(4)}{L_x(1)}=e^{-15}4^{24}\end{aligned}$$

(c) $\sum_{j=1}^{5}X_j$ is the sufficient statistics. $\sum X_j$ is distributed approximately normal N(5, 5).

$$P(\sum X_j>24|\theta=1)\approx P(z>\frac{24-5}{\sqrt{5}})=0$$

Or in S-plus,

```
 1-ppois(24, 5)
> 1.6 e-10
```