ECE 133A HW 1

Lawrence Liu

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Exercise T2.4

ϕ could be linear, from the three points, we can create a plane (a linear function) that spans all three points. However I could also create a concave or convex function that would also pass through all three points.

Exercise T2.8

(a)

$$\int p(x)dx = \sum_{i=1}^{n} c_i \frac{1}{i} x^i$$
$$\int_{\alpha}^{\beta} = \sum_{i=1}^{n} c_i \frac{1}{i}(\beta^i - \alpha^i)$$

therefore we have

$$a = \boxed{\left(c_1(\beta - \alpha)), ..., \frac{c_n}{n}(\beta^n - \alpha^n)\right)}$$

(b)

we have

$$p'(\alpha) = \sum_{i=1}^{n} (i-1) c_i \alpha^{i-2}$$

thus we get

$$b = \boxed{\left(0, c_2, ..., (n-1)\alpha^{n-2}\right)}$$

Exercise A1.2

let $u = (\sqrt{x_1}, ..., \sqrt{x_n})$ and $v = \left(\sqrt{\frac{1}{x_1}}, ..., \sqrt{\frac{1}{x_n}}\right)$, from Cauchy-Schwarz we have

$$< u, v >^2 \leq < u, u >< v, v >$$

$$n^2 \leq \left(\sum_{k=1}^{n} x_n\right)\left(\sum_{k=1}^{n} \frac{1}{x_k}\right)$$

$$\frac{1}{n}\sum_{k=1}^{n} x_k = n\left(\sum_{k=1}^{n} \frac{1}{x_k}\right)^{-1}$$

$$\frac{1}{n}\sum_{k=1}^{n} x_k = \left(\frac{1}{n}\sum_{k=1}^{n} \frac{1}{x_k}\right)^{-1}$$

Exercise T3.25

(a)

$$E[p] = \boxed{\theta\mu + (1-\theta)\mu^{\mathrm{rf}}\mathbf{1}}$$

$$
\begin{aligned}
Var(p) &= \theta^2\sigma^2 \\
\sqrt{Var(p)} &= \boxed{|\theta|\sigma}
\end{aligned}
$$