VE414 Appendix 3

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Common Discrete Distributions I

- Binomial

$$X \sim \mathrm{Binomial}\,(k, p)$$

- Probability mass function

$$f_X(x) = \frac{k!}{x!(k-x)!} p^x (1-p)^{k-x}$$

- Support

$$x \in \{0, 1, \ldots, k\}$$

- Mean and Variance

$$\mathbb{E}\,(X) = kp \qquad \mathrm{Var}\,(X) = kp(1-p)$$

Common Discrete Distributions II

- Geometric

$$X \sim \mathrm{Geometric}\,(p)$$

- Probability mass function

$$f_X(x) = p(1-p)^{x-1}$$

- Support

$$x \in \{1, 2, 3, \ldots\}$$

- Mean and Variance

$$\mathbb{E}\,(X) = \frac{1}{p} \qquad \mathrm{Var}\,(X) = \frac{1-p}{p^2}$$

Common Discrete Distributions III

- Negative Binomial

$$X \sim \mathrm{NegativeBinomial}\left(r, p\right)$$

- Probability mass function

$$f_X(x) = \frac{(x+r-1)!}{x!(r-1)!} p^x (1-p)^r$$

- Support

$$x \in \{0, 1, 2, 3, \ldots\}$$

- Mean and Variance

$$\mathbb{E}\left(X\right) = \frac{rp}{1-p} \qquad \mathrm{Var}\left(X\right) = \frac{rp}{(1-p)^2}$$

Common Discrete Distributions IV

- Poisson

$$X \sim \text{Poisson}\,(\lambda)$$

- Probability mass function

$$f_X(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

- Support

$$x \in \{0, 1, 2, 3, \ldots\}$$

- Mean and Variance

$$\mathbb{E}\,(X) = \lambda \qquad \text{Var}\,(X) = \lambda$$

Common Continuous Distributions I

- Normal

$$X \sim \mathrm{Normal}\left(\mu, \sigma^2\right)$$

- Probability density function

$$f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

- Support

$$x \in (-\infty, \infty)$$

- Mean and Variance

$$\mathbb{E}\left(X\right) = \mu \qquad \mathrm{Var}\left(X\right) = \sigma^2$$

Common Continuous Distributions II

- Exponential

$$X \sim \text{Exponential}\,(\lambda)$$

- Probability density function

$$f_X(x) = \lambda \exp(-\lambda x)$$

- Support

$$x \in [0, \infty)$$

- Mean and Variance

$$\mathbb{E}(X) = \lambda^{-1} \qquad \mathrm{Var}(X) = \lambda^{-2}$$

Common Continuous Distributions III

- Gamma

$$X \sim \mathrm{Gamma}\,(\alpha, \beta)$$

- Probability density function

$$f_X(x) = \frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} \exp\left(-\beta x\right)$$

- Support

$$x \in [0, \infty)$$

- Mean and Variance

$$\mathbb{E}\left(X\right) = \frac{\alpha}{\beta} \qquad \mathrm{Var}\left(X\right) = \frac{\alpha}{\beta^2}$$

Common Continuous Distributions IV

- Chi-Square

$$X \sim \text{Chi-Square}\,(k)$$

- Probability density function

$$f_X(x) = \frac{1}{2^{k/2}\Gamma(k/2)} x^{k/2-1} \exp\left(-\frac{x}{2}\right)$$

- Support

$$x \in [0, \infty)$$

- Mean and Variance

$$\mathbb{E}\,(X) = k \qquad \operatorname{Var}\,(X) = 2k$$

Common Continuous Distributions V

- Uniform

$$X \sim \mathrm{Uniform}\,(a, b)$$

- Probability density function

$$f_X(x) = \frac{1}{b-a}$$

- Support

$$x \in [a, b]$$

- Mean and Variance

$$\mathbb{E}\,(X) = \frac{1}{2}\,(a+b) \qquad \mathrm{Var}\,(X) = \frac{1}{12}\,(b-a)^2$$

Common Continuous Distributions VI

- Beta

$$X \sim \mathrm{Beta}\,(\alpha, \beta)$$

- Probability density function

$$f_X(x) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1}(1-x)^{\beta-1}$$

- Support

$$x \in [0,1]$$

- Mean and Variance

$$\mathbb{E}\,(X) = \frac{\alpha}{\alpha+\beta} \qquad \mathrm{Var}\,(X) = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$$

Back