SDS 383D The Multivariate Normal Distribution

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February 4, 2019

D: Affine Transformation of Independent Normals

$$x = Lz + \mu; \qquad z \sim \mathrm{N}(0, 1) \tag{1}$$

$$\mathrm{E}[x] = \mathrm{E}[Lz] + \mathrm{E}[\mu] = L\mathrm{E}[z] + \mu = \mu \tag{2}$$

$$\begin{aligned} \mathrm{cov}(x) &= \mathrm{cov}(Lz, Lz) + \mathrm{cov}(Lz, \mu) + \mathrm{cov}(\mu, Lz) + \mathrm{cov}(\mu\mu) && (3) \\ &= L\mathrm{cov}(z, z)L^T = LL^T && (4) \end{aligned}$$