

SDS 383D Propagating Uncertainty

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A: Standard Error

$$\hat{\Sigma} \approx \text{cov}(\hat{\theta}) = \text{E} \left[(\hat{\theta} - \bar{\theta})(\hat{\theta} - \bar{\theta})^T \right] \quad (1)$$

$$f(\theta) = \theta_1 + \theta_2 \quad (2)$$

$$\hat{\Sigma}_f = \text{cov}(\hat{\theta}_1 + \hat{\theta}_2) \quad (3)$$

$$= \text{E} \left[(\hat{\theta}_1 + \hat{\theta}_2)(\hat{\theta}_1 + \hat{\theta}_2) \right] \quad (4)$$

$$= \text{E} \left[\hat{\theta}_1^2 + 2\hat{\theta}_1\hat{\theta}_2 + \hat{\theta}_2^2 \right] \quad (5)$$

$$= \text{E} \left[\hat{\theta}_1^2 \right] + 2\text{E} \left[\hat{\theta}_1\hat{\theta}_2 \right] + \text{E} \left[\hat{\theta}_2^2 \right] \quad (6)$$

$$= \text{var}(\hat{\theta}_1) + 2\text{cov}(\hat{\theta}_1\hat{\theta}_2) + \text{var}(\hat{\theta}_2) \quad (7)$$

$$= \hat{\Sigma}_{11} + 2\hat{\Sigma}_{12} + \hat{\Sigma}_{22} \quad (8)$$

$$g(\theta) = \sum_{i=1}^p \theta_p \quad (9)$$

$$\hat{\Sigma}_g = \sum_{i=1}^p \sum_{j=1}^p \hat{\Sigma}_{ij} \quad (10)$$