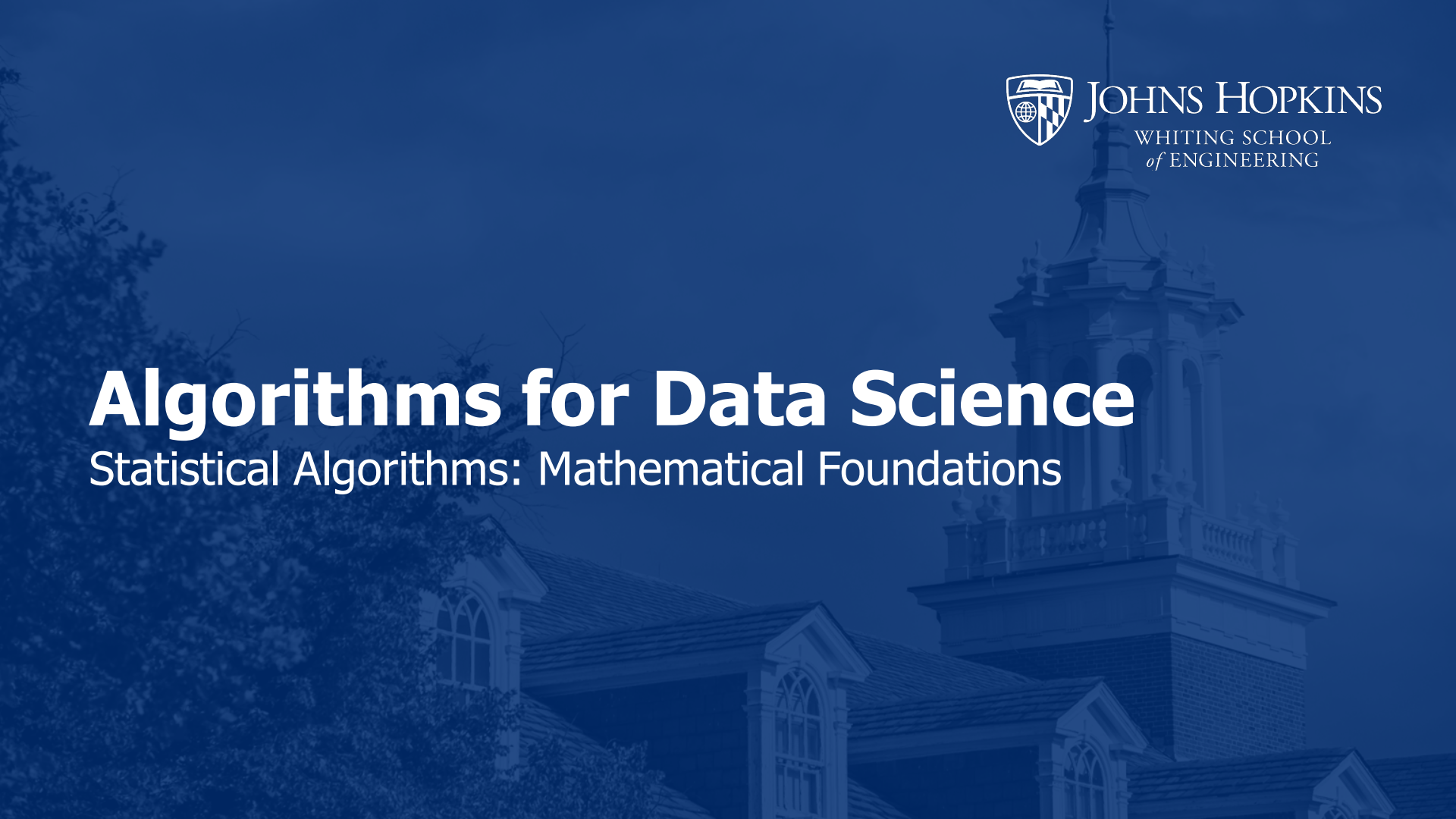
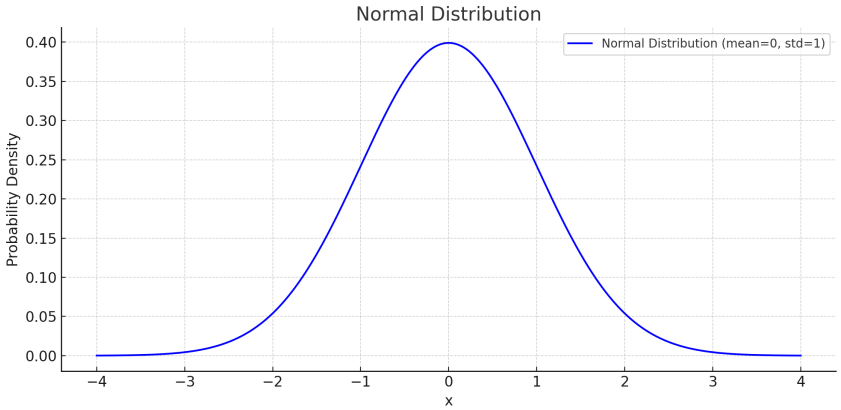
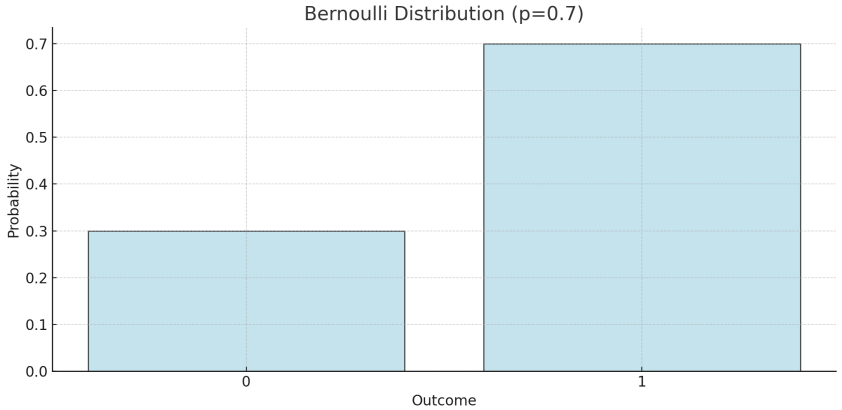


Algorithms for Data Science

Statistical Algorithms: Mathematical Foundations

Probability Distributions





Mathematical Foundations

Bayes' Theorem:

$$P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}$$

Expectation:

$$\mathbb{E}[X] = \sum_{x} xP(x)$$

Maximum Likelihood Estimation:

$$\hat{\theta}_{MLE} = \arg\max_{\theta} P(X \mid \theta)$$

Statistical Inference Foundations

- **Posterior Inference:**

$$P(\theta \mid X) \propto P(X \mid \theta)P(\theta)$$

- **Gaussian Mixture Modeling:**

$$P(X) = \sum_{k=1}^{K} \pi_k \mathcal{N}\left(x \mid \mu_k, \Sigma_k\right)$$