$$H_0: earnings = \alpha + \beta_1 ACT + \beta_2 SAT + \varepsilon$$
$$H_1: earnings = \alpha + \beta_1 ACT + \beta_2 SAT + \beta_3 Price + \beta_4 Public + \beta_5 PriAid + \varepsilon$$

$$H_0: additional\ parameters\ do\ not\ increase\ the\ VAF\ \left(R^2\right)\ significantly$$
$$H_A: additional\ parameters\ increase\ the\ VAF\ \left(R^2\right)\ significantly$$

$$grade = \alpha + \beta_1 state + \beta_2 country + \beta_3 class + \beta_4 stream + \varepsilon$$

$$F = \frac{(0.404 - 0.315) \div 3}{(1 - 0.404) \div 700}$$

$$Prior\ distribution: \mathbb{P}(\theta) = \begin{cases} 0.25, & \theta = 0.1 \\ 0.25, & \theta = 0.6 \\ 0.50, & \theta = 0.8 \end{cases}$$
$$Likelihood\ function: \mathbb{P}(Data \mid \theta) = \binom{N}{x} \theta^x (1-\theta)^{N-x}$$
$$Posterior\ distribution: \mathbb{P}(\theta \mid Data) = \frac{\mathbb{P}(\theta \cap Data)}{\mathbb{P}(Data)} = \frac{\mathbb{P}(Data \mid \theta) * \mathbb{P}(\theta)}{\mathbb{P}(Data)}$$

$$Binomial - Beta\ model:$$
$$Beta\ distribution: \mathbb{P}(\theta \mid \alpha, \beta) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\,\Gamma(\beta)} \theta^{\alpha-1}(1-\theta)^{\beta-1};\quad \Gamma(k) = (k-1)!;\qquad \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\,\Gamma(\beta)} = \frac{(\alpha+\beta-1)!}{(\alpha-1)!(\beta-1)!}$$
$$Binomial\ distribution: \mathbb{P}(X = x \mid \theta, N) = \binom{N}{x}\theta^x(1-\theta)^{N-x};\qquad \binom{N}{x} = \frac{N!}{x!(N-x)!}$$
$$Psuedocounts: x = number\ of\ successes = \alpha - 1;\quad N - x = number\ of\ failures = \beta - 1$$
$$Posterior\ distribution: \mathbb{P}(\theta \mid X = x, N, \alpha, \beta) = \frac{\Gamma(\alpha + \beta + N)}{\Gamma(\alpha + x)\,\Gamma(\beta + N - x)} \theta^{\alpha + x - 1}(1-\theta)^{\beta + N - x - 1} \sim Beta(x + (\alpha - 1), (N - x) + (\beta - 1))$$

$$\mathbb{P}(x = 0 | \theta = 0.1) = \binom{3}{0} 0.1^0 0.9^3 = 0.729$$
$$\mathbb{P}(x = 1 | \theta = 0.1) = \binom{3}{1} 0.1^1 0.9^2 = 0.243$$
$$\mathbb{P}(x = 2 | \theta = 0.1) = \binom{3}{2} 0.1^2 0.9^1 = 0.027$$
$$\mathbb{P}(x = 3 | \theta = 0.1) = \binom{3}{3} 0.1^3 0.9^0 = 0.001$$

Given that we believe we will succeed in 10% of cases what is the likelihood that in 3 trials we will succeed once? The answer is 0.243.

$$Bayes\ Rule: \mathbb{P}(A|B) = \frac{\mathbb{P}(A \cap B)}{\mathbb{P}(B)} = \frac{\mathbb{P}(B|A) * \mathbb{P}(A)}{\mathbb{P}(B)}$$
$$\mathbb{P}(A \cap B) = \mathbb{P}(B) * \mathbb{P}(A \mid B) = \mathbb{P}(A) * \mathbb{P}(B \mid A)$$