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## Computational Genomics Data Analysis

### Problem Set 4, Exercise 3

1. 3.941 E-6
2. 0.00443

Work shown below:

EX 3. 1)  $G_1 \sim N(0, 1)$   
 $G_2 \sim N(0, 1)$   
skip, stats, norm 2

2)  $G_2 | G_1 \sim N(G_1 + \frac{1}{2} G_2, 1)$   
3)  $G_4 | G_2 \sim N(2 G_2 + \frac{1}{2}, 2)$   
4)  $G_5 | G_3, G_4 \sim N(G_3 + G_4, 1)$

1.  $p(G_1 = 0.5, G_2 = 1, G_3 = 0, G_4 = -1, G_5 = 2)$   
 $p(X_1, \dots, X_n) = \prod_{i=1}^n p(X_i | \mu_i(x_i))$   
$$\left( \frac{1}{\sqrt{2 \cdot 1 \cdot \pi}} e^{-\frac{(0.5-0)^2}{2 \cdot 1}} \right) \left( \frac{1}{\sqrt{2 \cdot 1 \cdot \pi}} e^{-\frac{(1-0)^2}{2 \cdot 1}} \right) \left( \frac{1}{\sqrt{2 \cdot 1 \cdot \pi}} e^{-\frac{(0-0)^2}{2 \cdot 1}} \right) \left( \frac{1}{\sqrt{2 \cdot 1 \cdot \pi}} e^{-\frac{(-1-0)^2}{2 \cdot 1}} \right) \left( \frac{1}{\sqrt{2 \cdot 1 \cdot \pi}} e^{-\frac{(2-0)^2}{2 \cdot 1}} \right) = 3.941 E-6$$

2)  $p(G_5 = 2 | G_1 = 0.5, G_2 = 1, G_3 = 0, G_4 = -1)$   
3.941 E-6

$$\left( \frac{1}{\sqrt{2 \cdot 1 \cdot \pi}} e^{-\frac{(0.5-0)^2}{2 \cdot 1}} \right) \dots \text{normpdf}(1, 0, 1) \cdot \text{normpdf}(0, 0, 1 + \frac{1}{2} G_2, 1) \cdot \text{normpdf}(-1, 2 G_2 + \frac{1}{2}, 2)$$
  
$$= 0.00443$$