

$$1. m(a + bX) = \frac{1}{N} \sum_{i=1}^N a + bX = \frac{1}{N} \left(\sum_{i=1}^N a + b \sum_{i=1}^N X_i \right)$$

$$a \left(\frac{1}{N} \right) + b \frac{1}{N} \sum_{i=1}^N X_i = a + b m(X) \quad \checkmark$$

$$2. \text{cov}(X, X) = \frac{1}{N} \sum_{i=1}^N (X_i - m(X)) (X_i - m(X))$$

$$= \frac{1}{N} \sum_{i=1}^N (X_i - m(X))^2 = S^2 \quad \checkmark$$

$$3. \text{cov}(X, a + bY) = \frac{1}{N} \sum_{i=1}^N (X_i - m(X)) (a + bY_i - (a + b m(Y)))$$

$$bY_i - b m(Y) \rightarrow b(Y_i - m(Y))$$

$$\frac{1}{N} \sum_{i=1}^N (X_i - m(X)) b(Y_i - m(Y)) \rightarrow b \frac{1}{N} \sum_{i=1}^N (X_i - m(X)) (Y_i - m(Y))$$

$$= b \text{cov}(X, Y) \quad \checkmark$$

$$4. \text{cov}(a + bX, a + bY) = \frac{1}{N} \sum_{i=1}^N (a + bX_i - (a + b m(X))) (a + bY_i - (a + b m(Y)))$$

$$= \frac{1}{N} \sum_{i=1}^N (bX_i - b m(X)) (bY_i - b m(Y)) \rightarrow \frac{1}{N} \sum_{i=1}^N b(X_i - m(X)) b(Y_i - m(Y))$$

$$= b^2 \frac{1}{N} \sum_{i=1}^N (X_i - m(X)) (Y_i - m(Y)) \rightarrow b^2 \text{cov}(X, Y) \quad \checkmark$$

5. $b > 0$

$$\text{med}(a + bX) = a + b \text{med}(X) \quad \checkmark$$

should be true since scales same

$$\text{IQR}(a + bX) = a + b \text{IQR}(X) \quad \times$$

$$= a + b Q_3(X) - (a + b Q_1(X))$$

False no a in the final answer

$$6. m(X^2) = \frac{1}{N} \sum_{i=1}^N X_i^2 \quad m(\sqrt{X}) = \frac{1}{N} \sum_{i=1}^N \sqrt{X_i}$$

$$X^2 [1, 4] \quad m(X^2) = \left(\frac{1}{N} \sum_{i=1}^N X_i \right)^2$$

$$\frac{1}{2}(17) \neq \frac{1}{2}(5)$$

$$\sqrt{m(X)} = \sqrt{\frac{1}{N} \sum_{i=1}^N X_i}$$

$$\frac{1}{2}(3) \neq \sqrt{\frac{1}{2}(5)}$$