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EDA-Wrangling - Q6

1. $m(a+bX) = a+bm(X)$

$m(a+bX) = \frac{1}{N}\sum_{i=1}^{N}(a+bx_i)$

$= \frac{1}{N}\left(\sum_{i=1}^{N} a + b\sum_{i=1}^{N} x_i\right)$

$= a + b\frac{1}{N}\sum_{i=1}^{N} x_i$

$= a+bm(X)$ ✓

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

$= \frac{1}{N}\sum_{i=1}^{N}(x_i - m(X))^2$

$= s^2$ ✓

3. $m(a+bY) = a+bm(Y) \rightarrow cov(X, a+bY) = \frac{1}{N}\Sigma(x_i - m(X))[(a+by_i) - (a+bm(Y))]$

$= \frac{1}{N}\Sigma(x_i - m(X))b(y_i - m(Y))$

$= b\,cov(X,Y)$ ✓

4. $cov(a+bX, a+bY) = b^3 cov(X,Y)$

$cov(a+bx, a+bY) = \frac{1}{N}\Sigma b(x_i - m(X))b(y_i - m(Y))$

$= b^2 cov(X,Y)$ ✓

5. True; $med(a+bX) = a + b\,med(X)$ as this is a simple linear transformation that preserves the order when adding and multiplying a constant

$IQR(a+bX) = b\,IQR(X) \rightarrow$ False; this is because the IQR is a difference and the addition cancels

6. $X = \{1, 9\}$ $m(X) = 10/2 = 5$

$X^2 = \{1, 81\}$ $m(X^2) = 82/2 = 41$

$(m(X))^2 = 25 \neq 41$

} non-linear transformations will not preserve a $g(x) = g(m(x))$ relationship.