Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

1. **Let X be equally likely to be -11.3, 0, or 11.3, and define Y=X^2. Show Cov(X,Y)=0 and decide whether X and Y are independent.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

2. **A joint PMF assigns probability 1/6 to each pair (63,128), (69,144), (69,148), (75,152), (75,156), (81,172). Find Cov(X,Y) using E(XY)-E(X)E(Y).**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

3. **Paired observations (7 pairs): (56,60), (60,66), (58,66), (62,66), (60,66), (64,72), (62,66). Treat these as a sample. Find covariance using denominator n-1.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

4. **Paired observations (5 pairs): (-74,-222), (-70,-208), (-70,-206), (-66,-198), (-66,-196). Treat these as the whole population. Find covariance using denominator n.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

5. **Paired observations (5 pairs): (70,215), (73,225), (74,229), (77,236), (78,240). Treat these as the whole population. Find Var(2X-Y).**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

6. **Paired observations (8 pairs): (49,197), (53,218), (53,223), (57,229), (57,234), (61,255), (61,245), (65,266). Treat these as the whole population. Find Cov(3X+2,3Y+4).**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

7. **Paired observations (5 pairs): (22,19), (27,27), (26,29), (31,28), (30,30). Treat these as the whole population. Find correlation.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

8. **Paired observations (6 pairs): (-17,-52), (-13,-36), (-15,-38), (-11,-34), (-13,-36), (-9,-20). Treat these as the whole population. Find covariance using denominator n.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

Worked Answer Key

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

1. Let X be equally likely to be -11.3, 0, or 11.3, and define Y=X^2. Show Cov(X,Y)=0 and decide whether X and Y are independent.

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: Cov=0; X and Y are not independent

1. By symmetry E(X)=0 and E(XY)=E(X^3)=0, so covariance is 0.
2. Y is determined by X, and P(Y=0 | X=0)=1 differs from P(Y=0)=1/3, so they are dependent.

2. A joint PMF assigns probability 1/6 to each pair (63,128), (69,144), (69,148), (75,152), (75,156), (81,172). Find Cov(X,Y) using E(XY)-E(X)E(Y).

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 74.0000

1. E(X)=72.0000, E(Y)=150.0000, E(XY)=10874.0000.
2. Cov(X,Y)=10874.0000-(72.0000)(150.0000)=74.0000.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

Worked Answer Key

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

3. **Paired observations (7 pairs): (56,60), (60,66), (58,66), (62,66), (60,66), (64,72), (62,66). Treat these as a sample. Find covariance using denominator n-1.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 8.0000

1. Means are xbar=60.2857, ybar=66.0000.
2. Sum paired deviation products and divide by 6: covariance=8.0000.

4. **Paired observations (5 pairs): (-74,-222), (-70,-208), (-70,-206), (-66,-198), (-66,-196). Treat these as the whole population. Find covariance using denominator n.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 27.2000

1. Means are xbar=-69.2000, ybar=-206.0000.
2. Sum paired deviation products and divide by 5: covariance=27.2000.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

Worked Answer Key

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

5. **Paired observations (5 pairs): (70,215), (73,225), (74,229), (77,236), (78,240). Treat these as the whole population. Find Var(2X-Y).**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 9.3600

1. Var(2X-Y)=4Var(X)+Var(Y)-4Cov(X,Y).
2. Substitution gives 9.3600.

6. **Paired observations (8 pairs): (49,197), (53,218), (53,223), (57,229), (57,234), (61,255), (61,245), (65,266). Treat these as the whole population. Find Cov(3X+2,3Y+4).**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 886.5000

1. Translations do not change covariance and scaling multiplies it: Cov(aX+b,cY+d)=ac Cov(X,Y).
2. Cov(X,Y)=98.5000, so (3)(3)Cov(X,Y)=886.5000.

Name _____ Score _____ Teacher _____ Date _____

Covariance of Random Variables

Worked Answer Key

State whether data are a population or sample. Use the specified denominator, keep paired observations together, and distinguish zero covariance from independence.

7. **Paired observations (5 pairs): (22,19), (27,27), (26,29), (31,28), (30,30). Treat these as the whole population. Find correlation.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 0.8208

1. Cov=10.2800, Var(X)=10.1600, Var(Y)=15.4400.
2. r=Cov/sqrt[Var(X)Var(Y)]=0.8208.

8. **Paired observations (6 pairs): (-17,-52), (-13,-36), (-15,-38), (-11,-34), (-13,-36), (-9,-20). Treat these as the whole population. Find covariance using denominator n.**

Assumptions: The stated observations and denominator convention define the dataset; no pairs are omitted.

Paired products use matching observations. Population covariance divides by n; sample covariance divides by n-1.

Answer: 22.6667

1. Means are xbar=-13.0000, ybar=-36.0000.
2. Sum paired deviation products and divide by 6: covariance=22.6667.