A_M5

October 18, 2024

0.1 Module 5 Assessment

[ ]:
```r
library(testthat)
```

0.1.1 Problem 1

Let X be a random variable such that $E(X) = 3$, $sd(X) = 4$, and let Y be a r.v. such that $E(Y) = 1$, $sd(Y) = 2$. X and Y are not linearly independent, and $corr(X, Y) = 0.5$.

a) What is $E(X + 3Y + 1)$?

[ ]:
```r
e1.1 <- 3 + 3 * 1 + 1
```

[ ]:
```r
# Hidden test cell
```

b) What is $sd(4X + 2Y + 2)$? Round your answer to two decimal places.

[ ]:
```r
sd1.2 <- sqrt(16 * 16 + 4 * 4 + 2 * 4 * 2 * 4)
sd1.2 <- round(sd1.2, 2)
```

[ ]:
```r
# Hidden test cell
```

c) What is $E(3X - 2Y - 10)$?

[ ]:
```r
e1.3 <- 3 * 3 - 2 * 1 - 10
```

[ ]:
```r
# Hidden test cell
```

d) What is $sd(3X - 3Y - 5)$? Round your answer to two decimal places.

[ ]:
```r
sd1.4 <- sqrt(9 * 16 + 9 * 4 - 2 * 3 * 3 * 4)
sd1.4 <- round(sd1.4, 2)
```

[ ]:
```r
# Hidden test cell
```

0.1.2 Problem 2

Two components needed in automotive manufacturing each can be represented in 1 of 3 grades. Let X be the cost of the first component (in hundreds of dollars) and let Y be the cost of the second component (also in hundreds of dollars). The following table represents the weekly fraction of cars that utilize each combination of these components.

	y=7	y=9	y=10
x=7	0.05	0.05	0.10
x=9	0.05	0.10	0.35
x=10	0	0.20	0.10

a) What is $Cov(X, Y)$? Round your answer to three decimal places.

[ ]:
```
cov.xy <- 0.135
```

[ ]:
```
# Hidden Test Cell
```

b) Suppose the random variables measure the cost of each part in dollars, rather than hundreds of dollars. In this case, the random variables would be $U = 100X$ and $V = 100Y$. What is $Cov(U, V)$? (This question shows us how changing the units of the random variable can change the value of the covariance)

[ ]:
```
cov.uv <- 100^2 * cov.xy
```

[ ]:
```
# Hidden Test Cell
```

c) What is the correlation coefficient $\rho_{X,Y}$? Save this value as `rho.xy`. What is the correlation coefficient $\rho_{U,V}$? Save this value as `rho.uv`? Round your answers to three decimal places.

[ ]:
```
rho.xy <- 0.1428
rho.uv <- 0.1428
```

[ ]:
```
# Hidden Test Cell
```