

- d. (*Harder question*) Suppose that the covariance of a different sample of three cars with weight measured in lbs and efficiency in miles per gallon was 30. We are shipping the cars for sale in Canada. What is the covariance if we measure weight in kilograms (kgs) and distance is kilometers (km)? (1 mile=1.61 km, 1 lb=0.45 kilograms) (2 points)

Problem 2 (6 Points)

You flip a coin three times. The coin is fair, with $\Pr(\text{Head})=\Pr(\text{Tail})=.5$.

- a. Draw a Venn Diagram for this experiment (1 points)
- b. What is the probability that you will get exactly 2 heads? (2 points)
- c. What is the probability that you will get no more than 2 heads OR more than 1 tail? (3 points)

Problem 4 (8 Points)

On Professor Spearot's recent month long sabbatical, he played four 10 song gigs at the Red Room. He collected data on the number of original songs performed, "Originals", and tips earned, "Tips".

Originals	Tips
6	\$10
9	\$5
1	\$20
4	\$25

He wants to run the following regression:

$$Tips = \beta_0 + \beta_1 Originals + u$$

- a. Please compute $\hat{\beta}_0$ and $\hat{\beta}_1$ (2 points).

- b. If assumptions 1-4 from the proof shown in class hold so our estimate of $\hat{\beta}_1$ is an unbiased estimate of β_1 , how much money is gained or lost by playing an additional original song? (2 points)
- c. If assumptions 1-4 from the proof shown in class hold so our estimate of $\hat{\beta}_1$ is an unbiased estimate of β_1 , how much do I make in tips if all 10 songs are covers (not original)? (2 points)
- d. Compute and interpret the R-squared. (2 points)

Extra Credit: The original songs contain more screaming than the covers (non-original). That is, covers are positively correlated with screaming. Red Room patrons do not like screaming, and thus screaming tends to yield fewer tips. What assumption do we violate by estimating $Tips = \beta_0 + \beta_1 Originals + u$? Is the bias positive or negative? (2 points)


Extra Credit: What is the most important thing you will learn in this class (I said this in lecture)? (2 Points)

Helpful Formulas

$$\hat{\sigma}_x^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \hat{\mu}_x)^2 \quad \hat{\sigma}_{xy} = \frac{1}{n-1} \sum_{i=1}^n (x_i - \hat{\mu}_x)(y_i - \hat{\mu}_y) \quad \hat{\rho}_{xy} = \frac{\hat{\sigma}_{xy}}{\hat{\sigma}_x \hat{\sigma}_y}$$

$$\hat{\beta}_0 = \hat{\mu}_y - \hat{\beta}_1 \hat{\mu}_x \quad \hat{\beta}_1 = \frac{\sum_{i=1}^n (x_i - \hat{\mu}_x)(y_i - \hat{\mu}_y)}{\sum_{i=1}^n (x_i - \hat{\mu}_x)^2}$$

$$R^2 = 1 - \frac{SSR}{SST} \quad SSR = \sum_{i=1}^n (\hat{\mu}_i)^2 \quad SST = \sum_{i=1}^n (y_i - \hat{\mu}_y)^2$$



**Normal Distribution
from -∞ to Z**

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990