Economics 113 - Fall 2010 Professor Spearot
Introduction to Econometrics
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# Midterm Exam # 1 – 50 Points

The exam is closed book and closed notes. Please show your work step by step. Simple calculators may be used (no graphing or financial calculators and no cell phones or iPods)

**You must show your work to receive full credit**

*I have neither given nor received unauthorized aid on this examination, nor have I concealed any similar misconduct by others.*

*Signature* _____

**Problem 1 (10 points)**

The three largest departments in the division of social sciences are economics, psychology, and sociology. Economics had 1100 enrollments and an average "class size" of 41 enrollments per faculty in 2008-09. Psychology had 920 enrollments and an average class size of 31 enrollments per faculty. Sociology had 490 enrollments and an average class size of 31 enrollments per faculty. Calculate the correlation of department size and average class size.

$$\hat{\mu}_E = \frac{1}{3}(1100 + 920 + 490) = \frac{2510}{3} = 836.66$$

$$\hat{\mu}_{size} = \frac{1}{3}(41 + 31 + 31) = 34.33$$

$$\sigma_E^2 = \frac{1}{2}\left((1100 - 836.33)^2 + (920 - 836.66)^2 + (490 - 836.66)^2\right) = 98,233.33$$

$$\sigma_{size}^2 = \frac{1}{2}\left((41 - 34.33)^2 + (31 - 34.33)^2 + (31 - 34.33)^2\right) = 33.33$$

$$\Rightarrow \sigma_E = 313.42$$

$$\sigma_{size} = 5.77$$

$$\sigma_{E,size} = \frac{1}{2}\Big((1100 - 836.33)(41 - 34.33) + (920 - 836.66)(31 - 34.33) + (490 - 836.66)(31 - 34.33)\Big) = 1316.68$$

$$\rho_{enroll,size} = \frac{\sigma_{E,size}}{\sigma_E \sigma_{size}} = \frac{1316.68}{313.42 \cdot 5.77} = \boxed{0.728}$$

**Problem 2 (20 Points)**

Shoelace is a very talented football player. Suppose that Shoelace's rushing yards per game follows a normal distribution, with mean 200 and standard deviation 50.

a. What is the probability that Shoelace rushes for 231 yards in the next game? (5 points)

0 +5 (all or nothing)

b. What is the probability that Shoelace rushes for 100 yards or less in the next game? (5 points)

$Pr(S<100) = Pr\left(Z < \frac{100-200}{5}\right)$ +1

$= Pr(Z < -2) = 1 - Pr(Z < 2)$ +2

$= 1 - 0.9772$

$= \boxed{0.0228}$ +2

c. To win the Heisman, Shoelace needs to run for more than 150 yards a game in *all of the next 5 games*. Suppose that games are independent from one another, and that performance in each game follows the distribution described above. What is the probability Shoelace does not win the Heisman? (10 points)

$Pr(S>150) = Pr\left(Z > \frac{150-200}{50}\right) = Pr(Z > -1) = Pr(Z < 1)$

+2 +2

$= 0.8413$

Let $A_i$ be the event when $S>150$ in game $i$.

+5

$Pr(\text{Heisman}) = Pr(A_1 \cap A_2 \cap A_3 \cap A_4 \cap A_5) = (0.8413)^5$

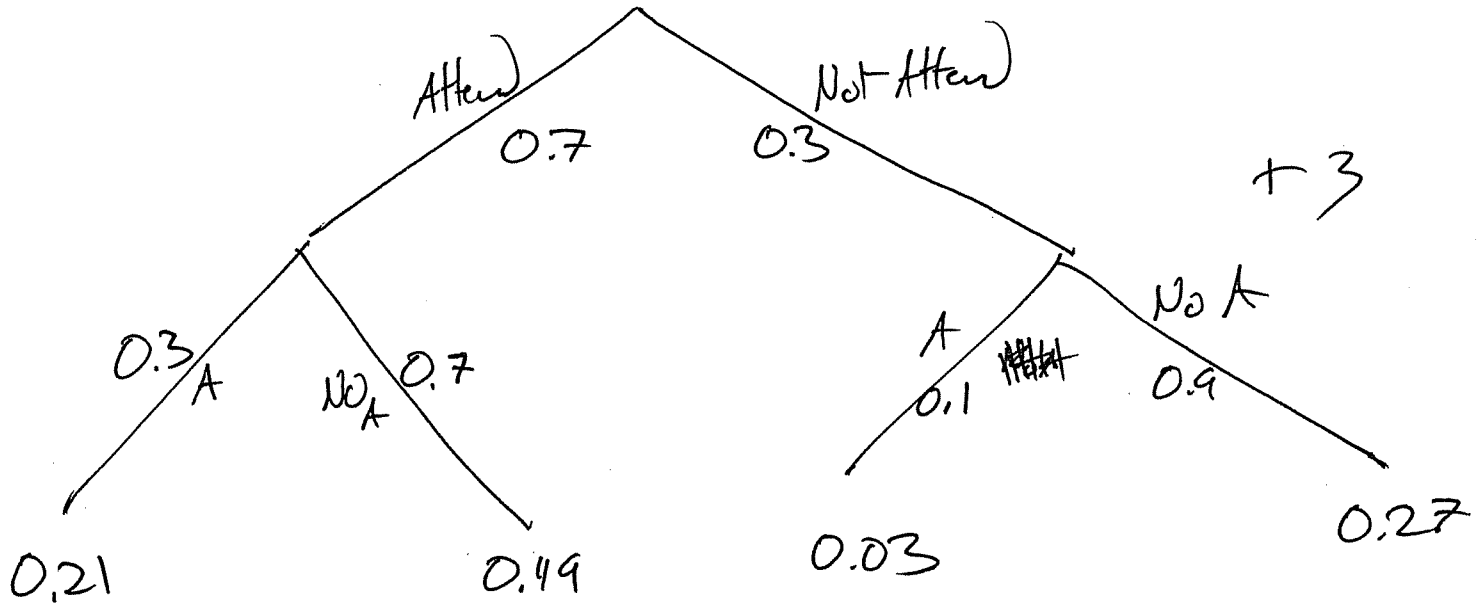
$= 0.42114$

$\boxed{Pr(\text{No Heisman}) = 1 - Pr(\text{Heisman}) = 0.5786}$

+3

**Problem 3 (20 Points)**

a.) The probability that you attend class is 0.7. If you attend class, the probability of getting an A on this exam is 0.3. If you don't attend class, the probability of getting an A is 0.1. Given that you do not get an A on the exam, what is the probability that you do not attend class? (10 Points)




+3

$$Pr(\text{Not Attend} \mid \text{No A}) = \frac{Pr(\text{Not Attend} \cap \text{Not A})}{Pr(\text{Not A})}$$ +3

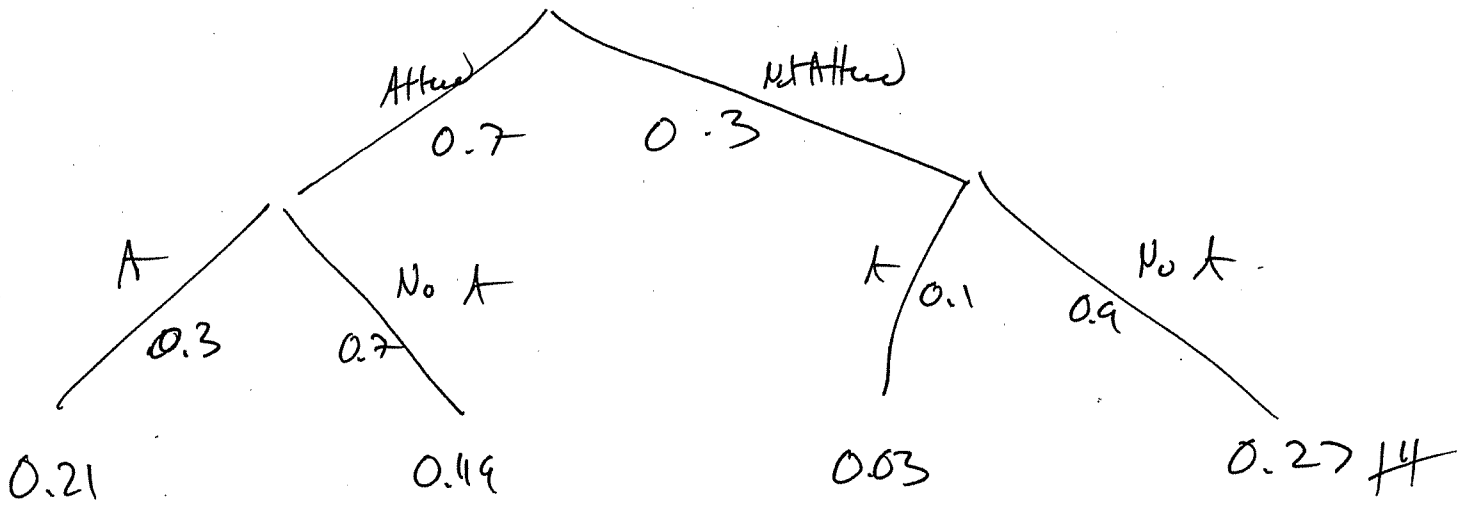
$$= \frac{Pr(\text{Not Attend} \cap \text{Not A})}{Pr(\text{Not Attend} \cap \text{Not A}) + Pr(\text{Attend} \cap \text{Not A})}$$

$$= \frac{0.27}{0.27 + 0.49}$$ +3

$$= \boxed{0.355}$$

+4

b.) Getting an A earns you a $50,000 job at LaHonda Motor Company. Not getting an A earns you a $20,000 job at Fresla Motors. By not attending class you earn $10,000 by day-trading. What is Expected Income? (10 Points)



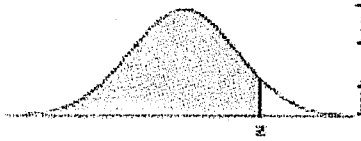

Payoff 50,000 20,000 60,000 30,000

$$\text{ExpInc} = 50{,}000 \cdot 0.21 + 0.49 \cdot 20{,}000 + 0.03 \cdot 60{,}000 + 0.27 \cdot 30{,}000$$ +4

**Expected Income = 30,200** +2

These may help:

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



# Normal Distribution from -oo 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 |