

Name ANSWER KEY ID \_\_\_\_\_

### Midterm Exam # 1 – 70 Points

The exam is closed book and closed notes. You may use a calculator, but no phones.

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 (20 Points)

Suppose that the Spearot Drought Severity Index represented by a normal distribution with mean 0 and standard deviation 1. Higher values imply a more severe drought.

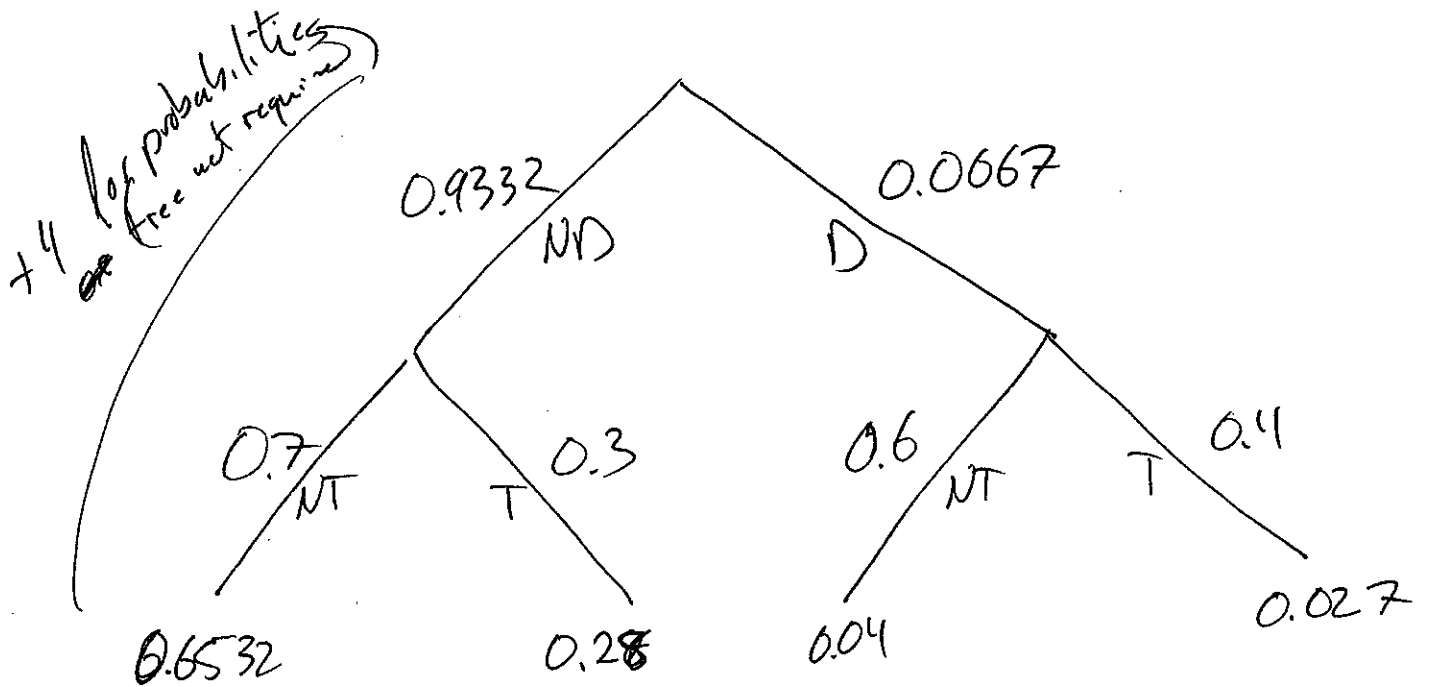
- a. What is the probability of the Spearot Drought Index taking on a value of exactly 0.5? (5 Points)

0 #5 as nothing

- b. Suppose that *severe drought* is classified as a Spearot index value above 1.5. What is the probability of a severe drought? (5 Points)

$$\begin{aligned} P_r(S > 1.5) &= P_r\left(Z > \frac{1.5 - 0}{1}\right) = P_r(Z > 1.5) \\ &= 1 - P_r(Z < 1.5) \\ &= 1 - 0.9332 \\ &= \boxed{0.0667} \end{aligned}$$

- c. Using the previous information, suppose that after a severe drought, there is a 0.4 probability of a tax increase. Absent a severe drought, there is a 0.3 probability of a tax increase. Given that we *did not* observe a tax increase, what is the probability that we observed a severe drought? (10 points)



$$\begin{aligned}
 P_r(D | NT) &= \frac{P_r(D \cap NT)}{P_r(D \cap NT) + P_r(ND \cap NT)} \\
 &= \frac{0.04}{0.04 + 0.6532} \\
 &= \boxed{0.0578}
 \end{aligned}$$

+4  
+2

**Problem 2 (30 Points)**

Suppose that we are interested in examining the effects of family income on educational attainment using a sample of young adults. To do so, we run the following regression:

$$\log(\text{educ}) = \beta_0 + \beta_1 \log(\text{faminc}) + u$$

Here, *faminc* is annual income of the respondent's family, and *educ* is years of college attained by the respondent.

- a. Suppose I estimate that  $\hat{\beta}_1 = 0.5$ . Please derive using derivatives the interpretation for  $\hat{\beta}_1$ . Please interpret this estimate. (10 Points)

$$\frac{d\text{educ}}{\text{educ}} = \beta_1 \frac{d\text{faminc}}{\text{faminc}} + u$$

$$\frac{d\text{educ}}{\text{educ}} \times 100 = \beta_1 \frac{d\text{faminc} \times 100}{\text{faminc}} + 2$$

$$\% \Delta \text{educ} = \beta_1 \% \Delta \text{faminc}$$

A one percent increase in family income yields a 0.5% increase in education +11

or: The elasticity of education with respect to family income is equal to 0.5. +6  
if elasticity



**Problem 3 (20 Points)**

Suppose that we are interested in examining the effects of iq on wage outcomes. To do so, we estimate the following equation:

$$wage = \beta_0 + \beta_1 iq + u$$

Here, *wage* is the monthly wage (in dollars) of the respondent, and *iq* is the points earned by the respondent on an IQ test. Estimating this equation yields the following:

$$wage = 2000 + 400iq$$

a. Please interpret the coefficient on *iq*. (5 points)

One additional point on the IQ test yields an increase in monthly wages by \$400. +2

b. Please interpret the intercept of this regression. (5 points)

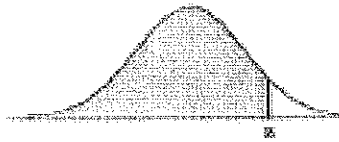
The predicted wage of someone that scores a zero on the IQ test is 2000 per month. +2

c. Suppose that we instead we instead estimate:

$$\log(wage) = 4 + 0.05iq$$

Please interpret the coefficient on *iq*. (10 points)

A one point increase in 'iq' increases wages by 5%. +4



## Normal Distribution from $-\infty$ 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