ECO220Y, Term Test #2

January 13, 2017, 9:10 – 11:00 am

U of T E-MAIL: _____@MAIL.UTORONTO.CA

SURNAME (LAST NAME):																		
GIVEN NAME (FIRST NAME):																		

UTORID: (e.g. LIHAO118)							

Instructions:

- You have 110 minutes. Keep these test papers closed on your desk until the start of the test is announced. You must stay for a minimum of 60 minutes.
- You may use a non-programmable calculator.
- There are 5 questions (all with multiple parts) with varying point values worth a total of 100 points.
- An answer guide for your response ends each question. It lets you know what is expected: e.g. a quantitative analysis, a graph, and/or sentences. Anything requested by the question and/or guide is required.
- Clearly show your work. Make your reasoning clear. Apply your understanding to the specific questions asked. Offer context-specific explanations rather than generic definitions or quotes from class or the book. Show that you can successfully *apply* your understanding to the specific circumstances presented.
- This test has 8 pages plus the *Supplement*. The *Supplement* contains the aid sheets (formula sheets and Normal table) as well as graphs, tables, and other information needed to answer the test questions. Anything written on the *Supplement* will *not* be graded. We will only collect these test papers, not the *Supplement.*
- Write your answers clearly, completely and concisely in the designated space provided immediately after each question. **Your entire answer must fit in the designated space provided immediately after each question.** No extra space/pages are possible. You *cannot* use blank space for other questions nor can you write answers on the *Supplement*.
    - **Write in pencil and use an eraser as needed.** This way you can make sure to fit your final answer (including work and reasoning) in the appropriate space.
    - Most questions give more blank space than is needed to answer. Follow the answer guides and avoid excessively long answers.
- For questions with multiple parts (e.g. (a) – (c)), attempt each part even if you had trouble with earlier parts.
- ***Unless otherwise specified, you choose the significance level. If there are no special considerations, you may choose a 5% significance level.***

(1) See ***Supplement for Question (1)***: "Why Is Infant Mortality Higher in the United States than in Europe?"

(a) [8 pts] *Approximately*, what is the mean and s.d. for Finland? *Make your reasoning and approximation method clear* and include the units of measurement for each. Answer with estimates and 2 – 4 sentences.

(b) [10 pts] Suppose the U.K. has a similar shaped distribution but a different mean and s.d. Further, it reports birthweights in pounds. If the 10^{th} percentile is 5.35 pounds and the 80^{th} percentile is 8.02 pounds, what is the mean and s.d. of birth weights in the U.K.? Answer with a quantitative analysis.

(2) See ***Supplement for Question (2)***: "The Market for Financial Advisor Misconduct."

(a) [8 pts] Find 7% and 15% in the EXCERPT. The value 0.07 is a marginal probability. Which kind of probability is 0.15? *Explain and formally state both probabilities using standard notation.* What does the inequality between 0.07 and 0.15 mean? *Explain and name* the relevant course concept. Answer with 2 – 3 sentences.

(b) [12 pts] How suspicious should you be of a financial advisor who leaves a firm? In other words, what is the chance that a financial advisor who leaves a firm has been disciplined for misconduct? Answer with a quantitative analysis and 1 precise sentence interpreting the probability that answers the question.

(3) [12 pts] Consider an inference about whether less than half of all Torontonians favor a toll on the DVP (Don Valley Parkway). In a random sample of 2,000 Torontonians, which range of results from the sample would convince a reasonable person that less than half of all Torontonians favor a toll? *Show your work* and write a single *precise* sentence clearly stating your answer in plain English. Answer with formal hypotheses in standard notation, a quantitative analysis and 1 precise and clear sentence.

(4) See ***Supplement for Question (4)***: Monte Carlo Simulations for Ontario Public Sector Salary Disclosure.

(a) [8 pts] Which has higher variance: Graph #1 or Graph #2? Which has higher variance: Graph #3 or Graph #4? *Name and explain* the relevant course concept. Answer with any relevant formulae and 2 – 4 sentences.

(b) [4 pts] From the STATA summary, fully interpret 106.586, which is in boldface. Make sure to specify the units and the context. Answer in 2 – 3 sentences.

(5) See ***Supplement for Question (5)***: "The Value of Postsecondary Credentials in the Labor Market: An Experimental Study."

(a) [8 pts] Why does Table 3 have so many rows? In other words, what is the idea behind reporting the results this way? Give <u>one</u> example of a question that the breakdowns in Table 3 could address. Answer with 2 – 3 sentences.

(b) [16 pts] Regardless of gender, *is there a difference* in callback rates between white and nonwhite applicants? Include a quantitative measure of the strength of the evidence. *Fully interpret your results.* Discuss whether the difference is statistically and/or economically significant. Answer with formal hypotheses in standard notation, a quantitative analysis, the P-value, and 2 – 3 sentences.

(c) [14 pts] For business jobs, *how large is the difference* in callback rates between job postings with an average salary less than $35,000 and job postings with an average salary of $65,000 or more? Make sure to offer a point estimate, a margin of error, and an interval. *Fully interpret your results.* Discuss the magnitude of your results (i.e. are they big, small, modest, etc.). Answer with a quantitative analysis and 2 – 3 sentences.

This *Supplement* contains the aid sheets (formula sheets and Normal table) as well as graphs, tables, and other information needed to answer the test questions. For each question directing you to this *Supplement*, make sure to carefully review all relevant materials. Remember, only your answers written on the test papers (in the designated space immediately after each question) will be graded. Any writing on this *Supplement* will *not* be graded.

Sample mean: $\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$ **Sample variance:** $s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{X})^2}{n-1} = \frac{\sum_{i=1}^{n} x_i^2}{n-1} - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n(n-1)}$ **Sample s.d.:** $s = \sqrt{s^2}$

Sample coefficient of variation: $CV = \frac{s}{\bar{X}}$ **Sample covariance:** $s_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{X})(y_i - \bar{Y})}{n-1} = \frac{\sum_{i=1}^{n} x_i y_i}{n-1} - \frac{(\sum_{i=1}^{n} x_i)(\sum_{i=1}^{n} y_i)}{n(n-1)}$

Sample interquartile range: $IQR = Q3 - Q1$ **Sample coefficient of correlation:** $r = \frac{s_{xy}}{s_x s_y} = \frac{\sum_{i=1}^{n} z_{x_i} z_{y_i}}{n-1}$

Addition rule: $P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$ **Conditional probability:** $P(A|B) = \frac{P(A\ and\ B)}{P(B)}$

Complement rules: $P(A^C) = P(A') = 1 - P(A)$ $P(A^C|B) = P(A'|B) = 1 - P(A|B)$

Multiplication rule: $P(A\ and\ B) = P(A|B)P(B) = P(B|A)P(A)$

Expected value: $E[X] = \mu = \sum_{all\ x} xp(x)$ **Variance:** $V[X] = E[(X-\mu)^2] = \sigma^2 = \sum_{all\ x}(x-\mu)^2 p(x)$

Covariance: $COV[X,Y] = E[(X-\mu_X)(Y-\mu_Y)] = \sigma_{XY} = \sum_{all\ x}\sum_{all\ y}(x-\mu_X)(y-\mu_Y)p(x,y)$

Laws of expected value:	**Laws of variance**:	**Laws of covariance**:
$E[c] = c$	$V[c] = 0$	$COV[X,c] = 0$
$E[X+c] = E[X] + c$	$V[X+c] = V[X]$	$COV[a+bX, c+dY] = bd * COV[X,Y]$
$E[cX] = cE[X]$	$V[cX] = c^2 V[X]$	
$E[a+bX+cY] = a + bE[X] + cE[Y]$	$V[a+bX+cY] = b^2V[X] + c^2V[Y] + 2bc * COV[X,Y]$	
	$V[a+bX+cY] = b^2V[X] + c^2V[Y] + 2bc * SD(X) * SD(Y) * \rho$ where $\rho = CORRELATION[X,Y]$	

Combinatorial formula: $C_x^n = \frac{n!}{x!(n-x)!}$ **Binomial probability:** $p(x) = \frac{n!}{x!(n-x)!}p^x(1-p)^{n-x}$ for $x = 0,1,2,\ldots,n$

If *X* is Binomial $(X \sim B(n,p))$ **then** $E[X] = np$ **and** $V[X] = np(1-p)$

If *X* is Uniform $(X \sim U[a,b])$ **then** $f(x) = \frac{1}{b-a}$ **and** $E[X] = \frac{a+b}{2}$ **and** $V[X] = \frac{(b-a)^2}{12}$

Sampling distribution of $\bar{X}$:	**Sampling distribution of $\hat{P}$**:	**Sampling distribution of $(\hat{P}_2 - \hat{P}_1)$**:
$\mu_{\bar{X}} = E[\bar{X}] = \mu$	$\mu_{\hat{P}} = E[\hat{P}] = p$	$\mu_{\hat{P}_2-\hat{P}_1} = E[\hat{P}_2 - \hat{P}_1] = p_2 - p_1$
$\sigma_{\bar{X}}^2 = V[\bar{X}] = \frac{\sigma^2}{n}$	$\sigma_{\hat{P}}^2 = V[\hat{P}] = \frac{p(1-p)}{n}$	$\sigma_{\hat{P}_2-\hat{P}_1}^2 = V[\hat{P}_2 - \hat{P}_1] = \frac{p_2(1-p_2)}{n_2} + \frac{p_1(1-p_1)}{n_1}$
$\sigma_{\bar{X}} = SD[\bar{X}] = \frac{\sigma}{\sqrt{n}}$	$\sigma_{\hat{P}} = SD[\hat{P}] = \sqrt{\frac{p(1-p)}{n}}$	$\sigma_{\hat{P}_2-\hat{P}_1} = SD[\hat{P}_2 - \hat{P}_1] = \sqrt{\frac{p_2(1-p_2)}{n_2} + \frac{p_1(1-p_1)}{n_1}}$

Inference about a population proportion:

***z* test statistic:** $z = \frac{\hat{P} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$ **CI estimator:** $\hat{P} \pm z_{\alpha/2}\sqrt{\frac{\hat{P}(1-\hat{P})}{n}}$

Inference about comparing two population proportions:

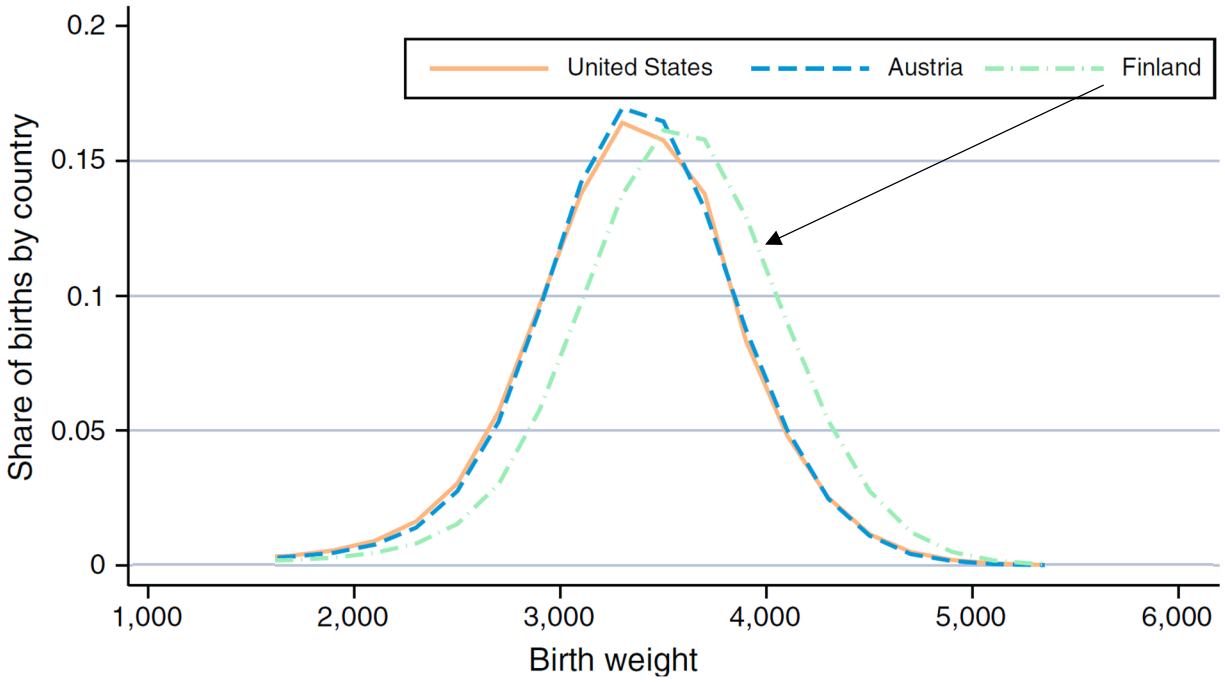
***z* test statistic under Null hypothesis of no difference:** $z = \frac{\hat{P}_2 - \hat{P}_1}{\sqrt{\frac{\bar{P}(1-\bar{P})}{n_1} + \frac{\bar{P}(1-\bar{P})}{n_2}}}$ **Pooled proportion:** $\bar{P} = \frac{X_1 + X_2}{n_1 + n_2}$

CI estimator: $(\hat{P}_2 - \hat{P}_1) \pm z_{\alpha/2}\sqrt{\frac{\hat{P}_2(1-\hat{P}_2)}{n_2} + \frac{\hat{P}_1(1-\hat{P}_1)}{n_1}}$

THE NORMAL TABLE IS ON THE LAST PAGE OF THIS SUPPLEMENT.

This space is intentionally left blank. *While you are free to use it for scratch work, remember that only your answers written on the test papers (in the designated space immediately after each question) will be graded. Any writing on this Supplement will NOT be graded.*

Supplement for Question (1): Consider a 2016 academic article "Why Is Infant Mortality Higher in the United States than in Europe?" by Alice Chen, Emily Oster, and Heidi Williams in the journal *American Economic Journal: Economic Policy* (DOI: 10.1257/pol.20140224). Consider Figure A1 (below) entitled "Distribution of Births by Birth Weight, By Country." This figure shows the distribution of birth weight, measured in grams, for each country.



Supplement for Question (2): Recall the 2016 *NBER* working paper "The Market for Financial Advisor Misconduct" (http://www.nber.org/papers/w22050). An excerpt and Table 8a, complete with explanatory notes, are below.

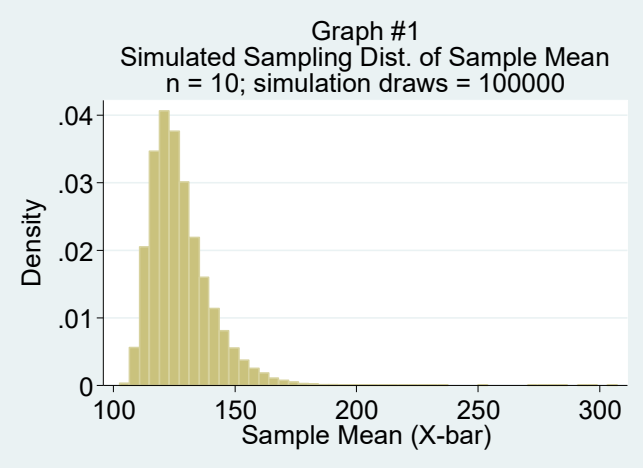
> **EXCERPT (from the Abstract):** We construct a novel database containing the universe of financial advisers in the United States from 2005 to 2015. Roughly 7% of advisers have misconduct records. At some of the largest financial advisory firms in the United States, more than 15% of advisers have misconduct records.

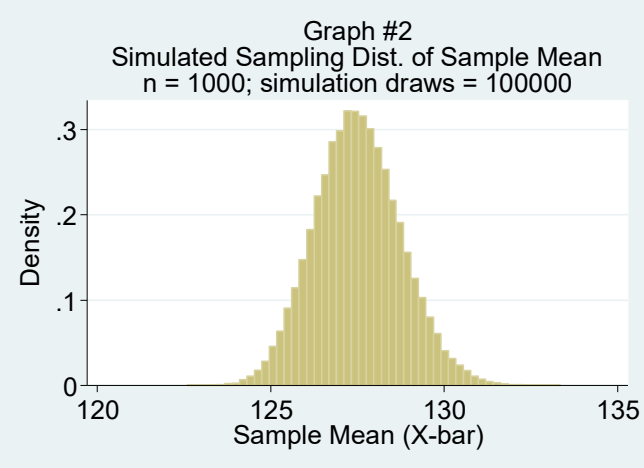
Table 8a. Consequences of Misconduct: Industry and Firm Discipline

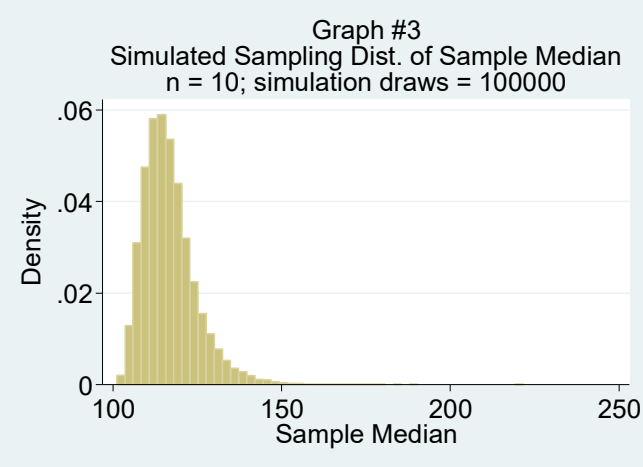
	No Misconduct	**Misconduct**
Remain with the Firm	81.29%	51.99%
Leave the Firm	18.71%	48.01%
Leave the Industry	8.92%	26.96%
Join a Different Firm (within 1 year) in the Industry	9.79%	21.05%

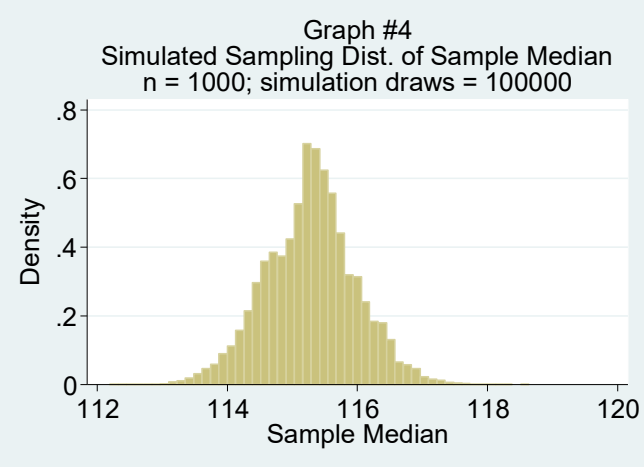
Note: Table 8a displays the average annual job turnover among financial advisers over the period 2005-2015. The table shows, on average, the percentage of advisers that remain with their firm, leave the industry (for at least one year) or join a new firm (within a year). The job transitions are broken down by whether or not the advisor was disciplined for misconduct in the previous year.

Supplement for Question (4): Recall the 2013 disclosure of 2012 Ontario public sector salaries for those paid $100,000 or more, which we discussed in lecture and homework. The disclosure includes salaries for 88,545 employees: the population mean is $127,518 and the population median is $115,301. Consider these Monte Carlo simulations for the sampling distribution of the sample mean and for the sampling distribution the sample median. The sample sizes (i.e. number of observations in each sample) are either 10 or 1,000. The number of simulation draws is 100,000 in all cases. Salaries are recorded in $1,000s.









Below is a STATA summary of the Monte Carlo simulation results displayed in Graph #3:

```
                        Sample Median
-------------------------------------------------------------
      Percentiles      Smallest
 1%     104.269       101.1792
 5%     106.586       101.2786
10%    108.1325       101.3693       Obs              100000
25%    111.2639       101.4255       Sum of Wgt.      100000

50%    115.5031                      Mean           116.7848
                        Largest       Std. Dev.      7.912126
75%    120.6517       178.4775
90%    126.8544        183.564       Variance       62.60173
95%     131.579       189.6576       Skewness       1.288682
99%    142.3349       221.6638       Kurtosis       6.264385
```

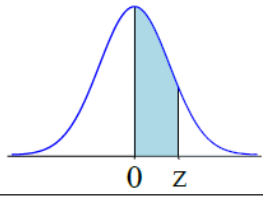
Supplement for Question (5): Consider a 2016 academic article "The Value of Postsecondary Credentials in the Labor Market: An Experimental Study" by David Deming et al in the journal *American Economic Review* (DOI: 10.1257/aer.20141757). This paper uses a type of field experiment called a resume audit study. Consider the excerpt and Table 3 below.

> **EXCERPT (p. 779):** We draw upon a vast online bank of actual resumes of job seekers to construct fictitious, but realistic, resumes that randomly vary the fictitious job applicant's characteristics including postsecondary institution. We use these resumes in applying to job vacancies in five major US metropolitan areas posted on a large, nationally-recognized job search website.

TABLE 3—SUMMARY STATISTICS FOR THE RESUMES USED IN THE AUDIT STUDY

	Callback rate	Number of resumes
Total	0.082	10,484
By city		
Chicago	0.082	2,036
Los Angeles	0.115	1,580
Miami	0.058	2,480
New York City	0.083	2,284
San Francisco Bay Area	0.083	2,104
By occupation and degree requirements		
AA, accounting/finance	0.045	1,084
AA, customer service/sales	0.125	2,920
BA, accounting/finance	0.044	1,928
BA, customer service/sales	0.104	2,172
Licensed practical nurse	0.057	804
Pharmacy technician	0.070	200
Medical assistant (administrative)	0.046	1,016
Medical assistant (clinical)	0.078	360
By race and gender		
White female	0.092	2,620
White male	0.066	2,456
Nonwhite female	0.090	2,680
Nonwhite male	0.077	2,728
By average salary (business jobs only)		
less than $35,000	0.105	2,497
$35,000 to $49,999	0.109	2,468
$50,000 to $64,999	0.080	1,254
$65,000 or more	0.048	1,448
No salary data	0.048	437

Note: The callback rate is the share of resumes that received a personalized callback (by phone or email) from a potential employer.



Normal Probabilities:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999