PART 1

Instructor: Prof. Murdock

Duration: 150 minutes; Students writing this test from 2:30 – 5:00 must stay in the test room for the entire 150 minutes. Students writing this test from 5:10 – 7:40 may not arrive late.

Allowed aids: A non-programmable calculator and attached aid sheets. You may detach the formula sheets and statistical tables (Standard Normal and Student t) stapled to this part.

Format: This test consists of two parts and a SCANTRON form. For both parts combined there are a total of 120 possible points.

BEFORE we announce the end of the test, enter your name & student # on BOTH graded pieces:
(1) the pink SCANTRON form
(2) Part 2

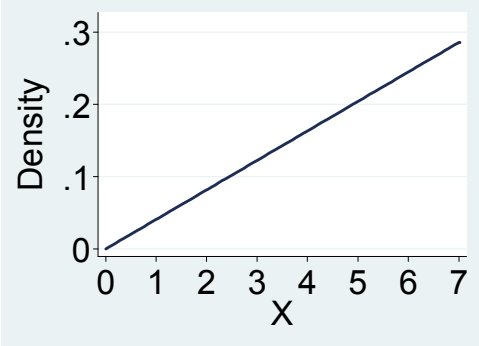
Part 1: 16 multiple choice questions worth 3 points each for a total of 48 points

- Answers must be properly recorded on the pink SCANTRON form to earn marks
- Print your **LAST NAME** and **INITIALS** in the boxes AND darken each letter in the corresponding bracket below each box; Sign your name in the **SIGNATURE** box
- Print your 9 digit **STUDENT NUMBER** in the boxes AND darken each number in the corresponding bracket below each box
- Your **FORM NUMBER** is **01**
- Use only a pencil or blue or black ball point pen
    - **Pencil strongly recommended** because it can be erased
- Make dark solid marks that fill the bubble completely
- Erase completely any marks you want to change
- Crossing out a marked box is not acceptable and is incorrect
- If more than one answer is selected then that question earns 0 points

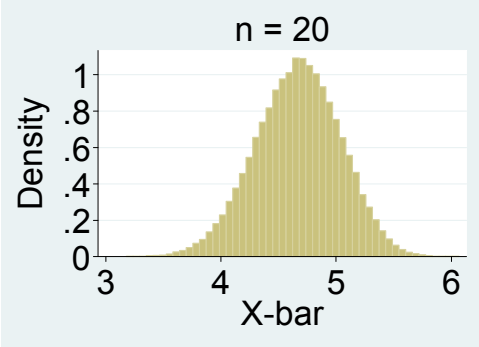
Part 2: 5 written questions worth a total of 72 points

► **Questions (1) – (3):** Consider this population density function that is defined between 0 and 7. Next is a histogram and STATA summary of the results of a Monte Carlo simulation.

Population density function:



Monte Carlo simulation results for the sample mean for a sample size of 20:



sample mean

Percentiles		Smallest		
1%	3.775919	3.180518		
5%	4.04634	3.197291		
10%	4.186301	3.200107	Obs	100000
25%	4.420578	3.204848		
50%	4.675678		Mean	4.666655
		Largest	Std. Dev.	.3689861
75%	4.921783	5.99326		
90%	5.135924	6.051901	Variance	.1361508
95%	5.259328	6.063583		
99%	5.47967	6.065079		

(1) What is the approximate population standard deviation?

(A) 0.0825
(B) 0.3690
(C) 1.0201
(D) 1.6502
(E) 2.0207

(2) For the specific case studied with the simulation, which of these statements is true?

Statement 1: The negative skew implies that E[X-bar] < μ

Statement 2: The sample size of 20 is sufficiently large to apply the Central Limit Theorem

Statement 3: The shape of the sampling distribution is different from the shape of a sample

(A) Only 1
(B) Only 2
(C) Only 1 and 2
(D) Only 1 and 3
(E) Only 2 and 3

(3) How should you expect the simulation results to differ if instead of 100,000 you use only 1,000 simulation draws?

Expectation 1: The standard error of the sample mean would likely increase

Expectation 2: The true shape the sampling distribution would likely be less clearly visible

Expectation 3: The sampling distribution of the mean would likely show a clear negative skew

(A) Only 1
(B) Only 2
(C) Only 3
(D) Only 2 and 3
(E) All three: 1, 2 and 3

(4) If a Binomial distribution has $0.6 \leq p \leq 0.9$ and $n = 10$, which is definitely true?

(A) $P(X = 5) > P(X = 4)$
(B) $P(X = 6) > P(X = 10)$
(C) $P(X = 8) > P(X = 7)$
(D) $P(X = 10) > P(X = 6)$
(E) $P(X = 10) > P(X = 9)$

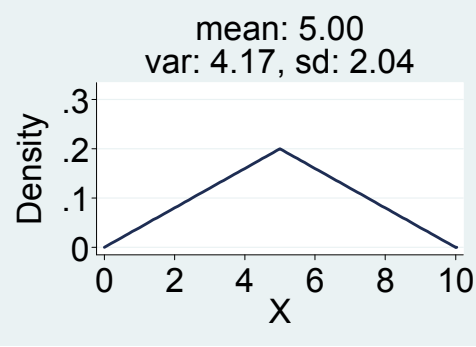
(5) Suppose a random variable X is Normally distributed. You wish to find P(X > 20). After standardizing you seek P(Z > 3). What does 3 mean?

(A) the standard deviation of the sample is 3
(B) the standard error of the sample mean is 3
(C) 20 is 3 times as big as the population mean
(D) 20 is 3 units higher than the population mean
(E) 20 is 3 standard deviations above the population mean

(6) If the degrees of freedom are 12 then what is P(-1.782 < t < 0)?

(A) 0.025
(B) 0.050
(C) 0.450
(D) 0.900
(E) 0.950

► **Questions (7) – (8):** Consider the following density function.



(7) What is P(2 < X < 8)?

(A) 0.840
(B) 0.845
(C) 0.850
(D) 0.855
(E) 0.860

(8) For a random sample of size 20, what is $P(4 < \overline{X} < 6)$?

(A) 0.34
(B) 0.36
(C) 0.38
(D) 0.97
(E) 0.99

(9) A population is negatively skewed. You estimate the population median using the sample mean and a sample size much greater than 30. Which properties would this estimator have?

(A) unbiased, consistent, relatively efficient
(B) biased, consistent, relatively efficient
(C) biased, consistent, not relatively efficient
(D) biased, inconsistent, relatively efficient
(E) biased, inconsistent, not relatively efficient

► **Questions (10) – (12):** A very large telemarketing firm claims that only 5 percent of its telephone calls involve inappropriate remarks being made by the telemarketing employee. A researcher secretly listens in on a random sample of telephone calls to investigate the claim.

(10) If the researcher listens in on 20 calls what is the chance that none of them involve an inappropriate remark?

(A) 0.00
(B) 0.05
(C) 0.12
(D) 0.24
(E) 0.36

(11) If the researcher listens in on 30 calls what is the chance that two of them involve an inappropriate remark?

(A) 0.26
(B) 0.29
(C) 0.32
(D) 0.35
(E) 0.38

(12) If the researcher listens in on 400 calls what is the chance that more than 24 of them involve an inappropriate remark?

(A) ≈ 0
(B) ≈ between 0.05 and 0.08
(C) ≈ between 0.15 and 0.18
(D) ≈ between 0.25 and 0.28
(E) ≈ between 0.35 and 0.38

(13) Which is a correct statement about what the Central Limit Theorem says?

Statement 1: The shape of the sampling distribution of the sample mean may change as the sample size changes

Statement 2: As the sample size gets sufficiently large the distribution of the sample becomes closer to the Bell shape

Statement 3: A sample drawn from any population will have the approximate Bell shape if the sample size is at least 30 and the approximation improves as the sample size grows

(A) Only 1
(B) Only 3
(C) Only 1 and 3
(D) Only 2 and 3
(E) All three are true: 1, 2 and 3

(14) The standard deviation of income is $30,750 and the population is highly skewed. How big of a sample should you collect if you wish to estimate with 96% confidence the average income with a margin of error of plus or minus $1,000?

(A) 2,559
(B) 2,913
(C) 3,633
(D) 3,994
(E) Because of the skew you cannot calculate this number

(15) You should expect the width of the confidence interval estimator of the population mean to stay the same (not change) if _____.

(A) sampling error is cut in half
(B) the sample size increases by 50
(C) all of the percentiles increase by 5 units
(D) the interquartile range decreases by 20 units
(E) the units of measurement change from dollars to $1,000 dollars

(16) You wish to make an inference about the fraction of students in favor of a proposed change in the tuition structure at a very large university. In which of the following cases would the sample proportion be subject to the LEAST amount of sampling error?

(A) You collect a sample size of 10 and 1% of the population is in favor of the proposal
(B) You collect a sample size of 20 and 50% of the population is in favor of the proposal
(C) You collect a sample size of 30 and 2% of the population is in favor of the proposal
(D) You collect a sample size of 40 and 30% of the population is in favor of the proposal
(E) You collect a sample size of 50 and 6% of the population is in favor of the proposal

PART 2

Last Name:																				
First Name:																				

Student #:								

Instructor: Prof. Murdock

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Part 1: 16 multiple choice questions worth 3 points each for a total of 48 points

Part 2: 5 written questions worth a total of 72 points

- For each question I give a guide for your response in brackets. It indicates what is expected: a quantitative analysis, a graph, and/or a written response. For example, "Is sampling error a plausible explanation for the result? [Analysis & 2 – 3 sentences]"
- Write your answers clearly, concisely, and completely below each question. You do not have to fill all of the blank space: a generous amount is provided for your convenience.
- Make sure to focus on answering the specific questions asked. Extraneous analysis does not earn positive marks even if it is correct and may earn negative marks if incorrect.
- Show all work and make sure you clearly show how you are analyzing each problem.
- For questions with multiple parts, attempt each part even if you had trouble with other parts.

	Q1	Q2	Q3	Q4	Q5	Part 2	Part 1	Total	**% Mark**
Point Value	*16*	*16*	*10*	*12*	*18*	*72*	*48*	*120*	
Points Earned									

(1) [16 points] A manager investigates the relationship between cumulative GPA from university and the size of the bonus (in dollars) after the first annual performance review of employees. Because the bonus is directly related to performance the goal is to determine how well CGPA predicts performance to help the firm with hiring decisions. The manager examines a scatter diagram and observes a linear relationship, calculates a coefficient of correlation of 0.4806 and produces STATA summaries of CGPA and bonus for a random sample of employees.

CGPA

	Percentiles	Smallest		
1%	1.9	1.9		
5%	2.2	2.2		
10%	2.5	2.4	Obs	32
25%	2.9	2.5		
50%	3.2		Mean	3.23125
		Largest	Std. Dev.	.5549993
75%	3.7	3.9		
90%	3.9	3.9	Variance	.3080242
95%	4	4		
99%	4	4		

bonus

	Percentiles	Smallest		
1%	1020	1020		
5%	1270	1270		
10%	1320	1320	Obs	32
25%	1530	1320		
50%	1760		Mean	1751.25
		Largest	Std. Dev.	329.9047
75%	1975	2200		
90%	2200	2280	Variance	108837.1
95%	2300	2300		
99%	2390	2390		

(a) [8 points] Find the least squares line. (Do not answer Part **(b)** here.) [Analysis & 1 equation]

Part (a) cont'd …

(b) [5 points] Interpret the intercept and the slope. [2 – 3 sentences]

(c) [3 points] "The employee with the lowest CGPA received the lowest bonus: the one with a CGPA of 1.9 received a bonus of $1020." Explain whether this is true or false. [1 – 2 sentences]

(2) [16 points] A professor teaches two identical sections of a course. Suppose iClicker claims it can improve students' marks on average and also decrease the variance among students by helping lower the number of students that fail. Specifically it claims that marks will increase by 3 percentage points and the standard deviation will decrease by 1 percentage point. The professor knows marks are negatively skewed and that typically the average is 68 and the standard deviation is 13. The professor has not used the iClicker before and decides to experiment by using the iClicker in Section 1, which has 48 students, and not in Section 2, which has 53 students.

(a) [12 points] If the claims about the iClicker are true, what is the chance that Section 1, which uses the iClicker, gets worse marks than Section 2? (Do not answer Part **(b)** here.) [Analysis]

Part (a) cont'd …

(b) [4 points] Interpret the probability you found in Part **(a)** and explain whether sampling error is a plausible explanation for the disappointing results from the experiment? [2 – 3 sentences]

(3) [10 points] The time needed to change the oil on a car is normally distributed with a standard deviation of 3 minutes. A researcher records the duration in minutes for a random sample of 50 oil changes and uses a tabulation to summarize these data. Compute the 90% confidence interval estimator of the mean. Interpret it. [Analysis & 1 sentence]

duration	Freq.	Percent	Cum.
10	2	4.00	4.00
11	9	18.00	22.00
12	2	4.00	26.00
13	3	6.00	32.00
14	4	8.00	40.00
15	8	16.00	56.00
16	4	8.00	64.00
17	7	14.00	78.00
18	4	8.00	86.00
19	6	12.00	98.00
22	1	2.00	100.00
Total	50	100.00	

(4) [12 points] A population is Bell shaped with a mean of 20 and a standard deviation of 20. For a random sample of size 5, what is the probability the sample mean is negative? Draw a carefully labeled graph of the sampling distribution that illustrates your answer. [Analysis & Graph]

(5) [18 points] Read this May 28, 2009 article "The behavioral effects of video games: Good game?" from the weekly magazine *The Economist*. In your answers refer to the four studies as:

Study A: Dr. Gentile's study of 161 American students

Study B: Dr. Gentile's study of 680 Singaporeans aged 12-14

Study C: Dr. Gentile's study of Japanese aged 10-17

Study D: Dr. Greitemeyer and Dr. Osswald's study of 46 German students

Playing video games can make you a better person

VIDEO games get a bad press. Many are unquestionably violent and, as has been the way with new media from novels to comic books to television, they have been accused of corrupting the moral fabric of youth. Nor are such accusations without merit. There is a body of research suggesting that violent games can lead to aggressive thoughts, if not to violence itself. But not all games are shoot-'em-ups, and what is less examined is whether those that reward more constructive behaviour also have lingering impacts. That, however, is starting to change. Two studies showing that video games have a bright side as well as a dark one have been carried out recently.

One, to be published in June by the *Journal of Experimental Social Psychology*, was conducted by Douglas Gentile, of Iowa State University's media research laboratory. He and his colleagues tested the effects of playing so-called "pro-social" games on children and young adults in three countries.

A group of 161 American students played one of six games for 20 minutes. Some were given "Ty2" or "Crash Twinsanity", both of which involve cartoonish fighting and destruction. Others were assigned "Chibi-Robo!", which involves helping characters in the game by doing their chores, or "Super Mario Sunshine", in which players clean up pollution and graffiti. A third group, acting as a control, played "Pure Pinball" or "Super Monkey Ball Deluxe", both of which involve guiding a ball through mazes.

Their games over, the participants were asked to choose 11 of 30 easy, medium or hard shape-based puzzles for a partner to complete, and told that their partner would receive a $10 gift voucher if he could complete ten of them. Those who had been playing pro-social games were significantly more likely to help their partner by selecting easy puzzles. The opposite was true for those assigned violent games.

The other parts of Dr Gentile's study looked at established behaviour. In one, a group of 680 Singaporeans aged 12-14 were asked to list their three favourite games and state the number of hours they played. They were then given questionnaires, the answers to which suggested that those who spent the longest playing games which involved helping others were most likely to help, share, co-operate and empathise with others. They also had lower scores in tests for hostile thoughts and the acceptance of violence as normal. In the second, Japanese aged 10-17 were asked how much time they spent playing games in which the main character helps others. When questioned three to four months later, those who played these types of games the most were also rated as more helpful to those around them in real life.

Screened for virtue

These two later parts of Dr Gentile's study might, of course, just be proving that nice people prefer pro-social games. But a second controlled experiment, by Tobias Greitemeyer of the University of Sussex, in England, and Silvia Osswald of Ludwig-Maximilian University, in Munich, confirms the gist of Dr Gentile's conclusions. In this piece of research (to be published later this year, also in the *Journal of Experimental Social Psychology*), Dr Greitemeyer and Dr Osswald asked 46 German students to play one of two classic games. In the pro-social one, "Lemmings", the aim is to protect rodents from various dangers. By contrast "Tetris" acted as a neutral control. In this game players rotate falling shapes so that they slot neatly together instead of saving self-destructive furry animals.

Playtime over, the students were asked to say what happens next in three incomplete stories involving a driver and a cyclist who narrowly miss colliding; two friends, one of whom is unapologetic despite being repeatedly late; and a diner speaking to a restaurant manager after waiting for an hour to be served and then having food spilt on him. Those who had played "Lemmings" suggested endings in which the characters in the stories exhibited significantly fewer aggressive thoughts, responses and actions than the ones suggested by the "Tetris" players.

The upshot of both studies is that video games are like any other medium. Feed the user with aggressive thoughts and you risk making him aggressive. Feed him with the milk of human kindness and the opposite will probably happen. No great surprise, perhaps. But a salutary reminder both that the older generation should not rush to judgment on youthful habits it does not understand, and that the medium is not always the message.

(a) [3 points] In your own words, state the primary research question. [1 question]

(b) [8 points] Which studies are based on observational data? Experimental data? Explain how you know which type of data each study yields. (Do not answer Part **(c)** here.) [5 - 6 sentences]

(c) [7 points] Can we infer a causal relationship from any of the studies? Explain. [3 - 4 sentences]

Extra Space: If you use this space, clearly indicate for which question(s).