Instructor: Prof. Murdock

Duration: 80 minutes. You may not leave the test room until at least 60 minutes have passed.

Allowed aids: A non-programmable calculator; Aid sheets given to you with test.

Format: This test has **24** multiple choice questions worth 3 points each for a total of 72 points. Answer on the pink SCANTRON form.

- 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

DEFEND YOUR ACADEMIC INTEGRITY: Make sure to cover your answers and do not write your letter answers to each question in large font next to each question. Providing assistance to another student writing a test is as bad as receiving assistance and is treated equally harshly. Despite our large numbers, students in our course have an excellent record regarding academic integrity and violations have been rare. Let us continue to behave in a way that is clearly professional and marked by integrity.

(1) If there is no sampling error then we expect a scatter diagram that will _____.

(A) have many dots
(B) display no scatter
(C) show a perfect linear relationship
(D) not suffer from any endogeneity bias
(E) All of the above

(2) Which is the best example of a random variable that is clearly discrete and not continuous?

(A) the sample mean
(B) the sample median
(C) the number of log-ins to the U of T portal in a randomly selected week
(D) the fraction of lectures cancelled by a randomly selected professor in Fall 2009
(E) the number of people in a randomly selected TTC train that is in service during rush hour

(3) What is the chance that any Normally distributed random variable will take a value that is more than half a standard deviation below its average?

(A) 0.2881
(B) 0.3085
(C) 0.3290
(D) 0.3544
(E) 0.6712

(4) It is claimed that one third of Canadians watch the CBC news in a typical week. Is it statistically plausible that in a random sample of five Canadians more than half watch the CBC news?

(A) No, that has less than a 0.1 percent chance of occurring
(B) Yes, that has about a 4.53 percent chance of occurring
(C) Yes, that has about an 11.41 percent chance of occurring
(D) Yes, that has about an 18.56 percent chance of occurring
(E) Yes, that has about a 20.99 percent chance of occurring

(5) In which of the following circumstances would the sample mean (X-bar) have the biggest variance and vary the most because of sampling error?

(A) $X \sim U[0, 100]$ and $n = 10$
(B) $X \sim U[0, 200]$ and $n = 20$
(C) $X \sim U[0, 400]$ and $n = 40$
(D) $X \sim N(0, 100)$ and $n = 10$
(E) $X \sim N(0, 200)$ and $n = 20$

(6) The distribution of profits for new restaurants is known to be positively skewed. A small random sample is collected. Which of these factors would affect the shape of the sampling distribution of the sample mean?

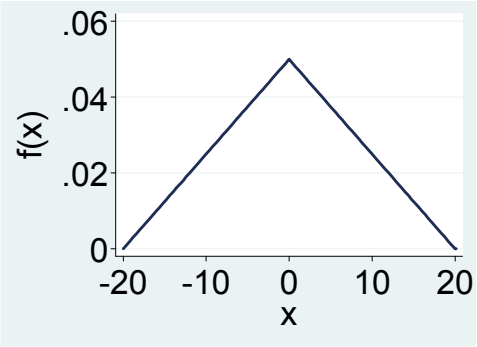
Factor 1: The sample size

Factor 2: The degree of skewdness of the population

Factor 3: The exact shape of a histogram of the sample

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

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



(7) If f(-10) = 0.025 and f(4) = 0.040, what is P(-10 < X < 4)?

(A) 0.015
(B) 0.065
(C) 0.485
(D) 0.515
(E) 0.555

(8) Which sample size makes P(-1 < X-bar < 1) smallest AND makes P(X-bar > 10) biggest?

(A) n = 2
(B) n = 8
(C) n = 10
(D) n = 29
(E) n ≥ 30

(9) Which are true statements about using a Monte Carlo Simulation to learn about the sampling distribution of the sample mean?

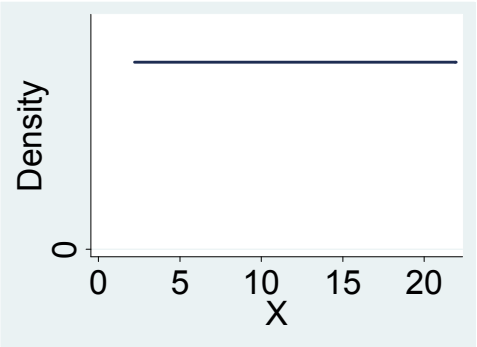
Statement 1: If the sample size is not sufficiently large then you should not use a simulation

Statement 2: If the number of simulation draws is sufficiently large then this ensures a Bell shape

Statement 3: If you have a very large sample size that is clearly sufficiently large—the CLT applies—then it is pointless to do a simulation

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

► **Questions (10) – (11):** Suppose X ~ U[2.23, 21.89]. Here is a partially labeled graph.



(10) What is the probability of a value between 10 and 15 if you randomly draw one observation?

(A) 0.2487
(B) 0.2500
(C) 0.2543
(D) 0.2609
(E) 0.2671

(11) Suppose you standardize X to create Y: Y = $(X - \mu)/\sigma$. What are the shape and parameters of the transformed variable?

(A) Y is Normal with $\mu = 0$ and $\sigma^2 = 1$
(B) Y is Uniform with a = 0 and b = 1
(C) Y is Uniform with a = -1 and b = 1
(D) Y is Uniform with a = -1.21 and b = 1.21
(E) Y is Uniform with a = -1.73 and b = 1.73

(12) Which of these statements comparing the variability of two samples are true?

Statement 1: If Sample 1 has a bigger range then it also has a bigger variance

Statement 2: If Sample 1 is Normal and Sample 2 is Uniform then Sample 2 has a bigger variance

Statement 3: If both samples have a range of 0 then both samples have the same degree of variability

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

► **Questions (13) – (14):** The Globe and Mail has investigated the excessive sodium in Canadian foods such as breakfast cereals, frozen dinners, and canned goods. Manufacturers are resisting voluntarily lowering the sodium because they claim it would harm the taste and hurt their sales. In other countries such as Britain consumers have not noticed lower sodium. University researchers conduct an experiment to test how Canadians react to reduced salt. 100 students at a large Canadian university volunteer to be part of the study: they are not told the research question. Half are randomly assigned a low sodium version of assorted foods and half are randomly assigned a high sodium version of the same foods. Participants rate tastiness on a scale from 0 to 100. It is known that the standard deviation of ratings across foods is 10. The sample average rating of the low sodium foods is 65. The sample average rating of the high sodium foods is 69.

(13) If in fact people think that low and high sodium foods are equivalent in terms of taste, what is the chance that the high sodium foods would receive a higher average rating in the study above?

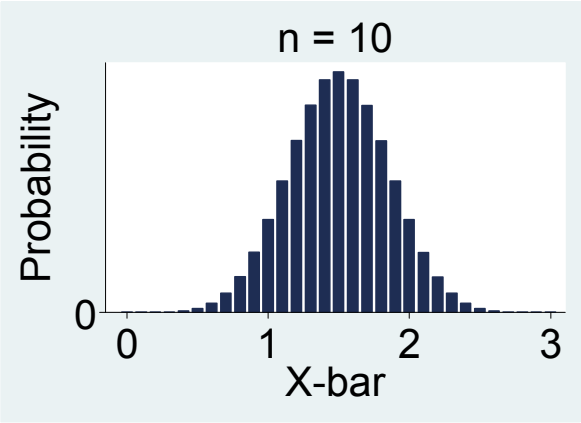
(A) 0
(B) 0.0040
(C) 0.05
(D) 0.4960
(E) 0.5

(14) An industry representative claims that high sodium foods on average receive a substantially higher rating: an 8 point better rating on average. If that claim is true, what is the chance that sampling error explains getting a difference as small that found in the study above?

(A) ≈ 0
(B) 0.0062
(C) 0.0129
(D) 0.0228
(E) 0.0315

► **<u>Questions (15) – (18)</u>:** The table below shows the population distribution of X. The questions relate to the sampling distribution of the sample mean for either a sample size of 3 or a sample size of 10. For a sample size of 10, simulation results are provided: a graphical summary (the vertical scale has been intentionally erased) and a STATA summary.

x	p(x)
0	0.25
1	0.25
2	0.25
3	0.25



X_bar

Percentiles		Smallest		
1%	.7	0		
5%	.9	0		
10%	1	0	Obs	10000000
25%	1.3	0		
50%	1.5		Mean	1.499776
		Largest	Std. Dev.	.3535634
75%	1.7	3		
90%	2	3	Variance	.1250071
95%	2.1	3		
99%	2.3	3		

(15) For <u>n = 3</u>, what is the chance that the sample mean is 8/3?

(A) 0
(B) 0.016
(C) 0.033
(D) 0.047
(E) 0.064

(16) For <u>n = 3</u>, how can we calculate the standard error of the sample mean?

(A) $(0.25*(0 - 1.5)^2 + 0.25*(1 - 1.5)^2 + 0.25*(2 - 1.5)^2 + 0.25*(3 - 1.5)^2)^{0.5}$
(B) $(0.25*(0 - 1.5)^2 + 0.25*(1 - 1.5)^2 + 0.25*(2 - 1.5)^2 + 0.25*(3 - 1.5)^2)^{0.5}/3^{0.5}$
(C) We need to use a Monte Carlo Simulation to calculate it
(D) It cannot be calculated because n = 3 is not sufficiently large
(E) It cannot be calculated because we have insufficient information

(17) For n = 10, what is the best estimate of the probability that the sample mean is equal to 1.7?

(A) 0
(B) 0.08
(C) 0.10
(D) 0.14
(E) 0.75

(18) For n = 10, which are important differences between the graph above that is generated by a computer and a graph that can be reasonably generated by hand (actually tossing coins)?

Difference 1: The graph above would have a smaller variance

Difference 2: The graph above would be less subject to simulation error

Difference 3: The graph above would show less sampling error in the sample mean

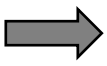
(A) Only 1
(B) Only 2
(C) Only 3
(D) Only 1 and 2
(E) Only 1 and 3

(19) How many parameters does the *F* distribution have?

(A) 0
(B) 1
(C) 2
(D) fewer parameters than the Standard Normal distribution
(E) the same number of parameters as the Student t distribution

(20) If the sample size is 11, what is the chance that the t-statistic is less than -2.764?

(A) 0.01
(B) 0.02
(C) 0.49
(D) 0.98
(E) 0.99



► **Questions (21) – (24):** Employees are given performance ratings in June and November. In both months ratings are Bell shaped; the average is 70 and the standard deviation is 10. Ratings are correlated as an employee's performance is often fairly consistent. The coefficient of correlation is 0.6.

(21) If managers classify employees in the 99^{th} percentile and higher as "exceptional," to the nearest integer which rating does an employee need to obtain to be exceptional?

(A) 91
(B) 93
(C) 95
(D) 98
(E) 99

(22) For 3 randomly selected employees what is the chance that on average their June ratings are greater than 80?

(A) ≈ 0.00
(B) 0.02
(C) 0.04
(D) 0.11
(E) 0.16

(23) For 3 randomly selected employees what is the chance that all three have a June ratings greater than 80?

(A) ≈ 0.00
(B) 0.02
(C) 0.04
(D) 0.11
(E) 0.16

(24) If managers determine the end-of-year bonus by averaging the June and November performance ratings to obtain an "overall year rating," what is the standard deviation of the overall year rating?

(A) 7.07
(B) 8.94
(C) 10
(D) 14.14
(E) it cannot be determined

Your **FORM** number is **01**. Complete the **FORM** box at the top right of your pink SCANTRON form.

Marks will be posted ASAP: I will alert you with an e-mail. Remember the password is _____.