Name (Print) : _____

Instructor (circle one):   Ayu   Eagan   Findsen

                                      Sellke   Troisi

Class Time: 11:30 AM   12:30 PM   1:30 PM

               2:30 PM   3:30 PM   4:30 PM   ONLINE

Instructions:

1.   You are expected to uphold the honor code of Purdue University. It is your responsibility to keep your work covered at all times. Anyone cheating on the exam will automatically fail the course, and will be reported to the Office of Dean of Students.

2.   Please alert proctors if you observe any cheating during the exam. We highly appreciate it.

3.   It is strictly prohibited to smuggle this exam outside. Your exam will be returned to you after it is graded.

4.   You may have one double-sided 8.5 in x 11 in crib sheet to take this test. The crib sheet can be handwritten or typed.

5.   The only materials that you are allowed are your calculator, writing utensils and erasers and your crib sheet. If you bring any other papers in to the exam, you will get a **zero** on the exam. We will provide scratch paper if you need more room.

6.   Leave all your belongings except those permitted for the exam in the front of the room. We are not responsible for any loss.

7.   If you share your calculator or use a cell phone, you will get a **zero** on the exam.

8.   Breaks (including bathroom breaks) during the exam are **not** allowed. If you leave the exam room, you must turn in your exam and you will not be allowed to come back.

9.   You must show **ALL** your work to obtain full credit. An answer without showing any work may result in **zero** credit.

10. All numeric answers should have **two decimal places** except answers from the z-table should have **four decimal places**.

11. If your work is not readable, it will be marked wrong.

12. After you complete the exam, please staple your crib sheet, tables and any scrap paper to the exam and hand it in. Please show your Purdue picture ID.

Your exam is not valid without your signature below.

STUDENT: I attest here that I have followed the instructions above honestly while taking this test and that work submitted is my own, produced without assistance from books, other people, notes other than my own crib sheets, or other aids.

Signature of Student: _____

	Points Earned	Grader Initials
Problem 1 (20 points)		
Problem 2 (15 points)		
Problem 3 (20 points)		
Problem 4 (15 points)		
Problem 5 (15 points)		
Problem 6 (20 points)		
Total (105 / 100)		

1. **(20 points)** Your body needs vitamin D to use calcium when building bones. It is particularly important that young adolescents have adequate supplies of this vitamin because their bodies are growing rapidly. Vitamin D in the form 25-hydroxy vitamin D is measured in the blood and represents the stores available for the body to use. The units of measurement are nanograms per milliliter (ng/mL) of blood. Here are some values measured on a sample of 20 adolescent girls aged 11 to 14 years:

16	43	38	48	42	23	36	35	37	34
25	28	26	43	51	33	40	35	41	42

a) (5 points) Make a stemplot.

b) (4 points) Find the five number summary for the data. Show your work.

c) (2 points) What is the IQR?

d) (4 points) Are there any outliers? Justify your answer.

e) (5 points) Draw a boxplot.

2. **(15 points)** Americans aged 18 to 29 years send an average of almost 88 text messages a day. Suppose that the time X between text messages (**in hours**) sent from your cell phone can be modeled by a continuous distribution with density function

$$f(x) = 4\,e^{-4x} \quad \textit{for } x \geq 0$$
$$ = 0 \qquad\quad \textit{elsewhere}$$

a) (3 points) Sketch the density function.

b) (6 points) What is the probability that X exceeds 30 minutes? Please shade the area representing the probability on your graph in part (a).

c) (6 points) What is the median?

3. **(20 points)** Osteoporosis is a condition in which the bones become brittle due to loss of minerals. To diagnose osteoporosis, an elaborate apparatus measures bone mineral density (BMD). BMD is usually reported in standardized form (i.e. z-score). The standardization is based on a population of healthy young adults. The World Health Organization (WHO) criterion for osteoporosis is a BMD 2.5 standard deviations below the mean for young adults. BMD measurements in a population of people similar in age and sex roughly follow a Normal distribution.

(a) (5 points) What percent of healthy young adults have osteoporosis by the WHO criterion?

(b) (5 points) Women aged 70 to 79 are of course not young adults. The mean BMD in this age is **−2** on the standard scale for young adults. Suppose that the standard deviation is the same as for young adults. Sketch the Normal curve representing BMD of women aged 70 to 79.

c) (5 points) What percent of this older population (Women aged 70 to 79) has osteoporosis? Shade the area representing the percentage on your sketch in part b).

d) (5 points) What BMD value must women aged 70 to 79 have in order to be the strongest 25% of this older population? (As stated in the problem, BMD value is the z-score based on a population of healthy young adults.)

4. **(15 points)** What is the impact of caffeine on performance in endurance cycling races? Three hundred cyclists were divided into 3 groups, and each group was given one of three doses of caffeine (0, 3, 6 mg/kg) in a drink, and the time to cycle the equivalent of 40 km on a stationary bicycle was recorded.
Answer the following question as specific as possible.

a) (2 points) What are the experimental subjects?

b) (2 points) What are the treatments?

c) (2 points) What is the response variable?

d) (9 points) Use a diagram to outline a completely randomized design for the study.

5.   **(15 points)** A recent survey describes the distribution of the sleep time per night among college students as approximately Normally distributed with mean μ = 6.8 hours and standard deviation σ = 1.25 hours. You plan to take an SRS of size n = 25 and compute the average total sleep time.

   a) (4 points) What is the mean and the standard deviation for the average sleep time in an SRS of 25?

   b) (3 points) What is the distribution of the average sleep time in an SRS of 25? Explain your answer.

   c) (8 points) What is the probability that the average sleep time will be below 6.9 hours?

6.   **(20 points)** The table below is the probability mass function for X, the total number of dogs and cats owned per household, for the households in a large suburban area. For example, 14% of the households own 2 of the pets.

xi	0	1	2	3	4	5	6	7
p(xi)	0.36	0.24	0.14	0.09	0.07	0.04	0.04	0.02

According to a local law, each household in this area is prohibited from owning more than 3 of these pets. If a household in this area is selected at random, the probability that the selected household will be in violation of this law is 0.17.

   a) (4 points) If 10 households in this area are selected at random, what is the distribution of the number of households that are in violation of the law? Justify your answer.

   b) (8 points) If 10 households in this area are selected at random, what is the probability that less than 3 of them will be in violation of this law?

   c) (8 points) If 1000 households in this are selected at random, what is the probability that less than 200 of them will be in violation of this law?

This Page is Intentionally Left Blank

This Page is Intentionally Left Blank