STAT 371 Exam 1

NetID (mine is “jgillett” from “jgillett@wisc.edu”): _____________

Last name: ___________________________  First name: ___________________________

Discussion (check one):

_____ 311 TuTh 10:20-11:10 Mechanical Engineering 1152 Brown, Jared and Huang, Kunling
_____ 312 TuTh 10:20-11:10 Russel Labs 104 Hu, Bowen and Cao, Wenzhi
_____ 321 TuTh 1:10-2:00 Van Hise 387 Xu, Yuqing and Huang, Kunling

Instructions.

1. Do not open the exam until I say “go.”
2. Put away everything except a pencil, a calculator, and your one-page (two sides) notes sheet.
3. Attempt all questions.
4. Show your work clearly. Correct answers without enough work may receive no credit.
5. Find the needed table(s) at the end of the packet. You may tear the tables sheet(s) free.
6. If a question is ambiguous, resolve it in writing. We will consider grading accordingly.
7. The exam will end when I call time. If you continue writing after I call time, you risk a penalty. (The alternative, that you get more time than your peers, is unfair.)
8. You are welcome to turn your exam in to me before I call time. However, if you are still here in the last five minutes, please remain seated until I’ve picked up all the exams.
9. Good luck!

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
<th>Your Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>20</td>
<td></td>
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<tr>
<td>Q2</td>
<td>10</td>
<td></td>
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<tr>
<td>Q3</td>
<td>20</td>
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<tr>
<td>Q4</td>
<td>10</td>
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<td>Q5</td>
<td>20</td>
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<tr>
<td>Q6</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>
1. (20 points) Suppose NBA player weights (in pounds) are $N(221, 15^2)$.

   (a) Find the weight such that 20\% of players weigh less than that weight.

   (b) A random group of 5 NBA players (still with weights from $N(221, 15^2)$) cross a playground bridge together, even though its breaking strength is only 1000 pounds. What is the probability that it breaks?
2. (10 points) Here are several questions about summary statistics.

(a) Consider these summary statistics:

- $IQR =$ interquartile range
- $M =$ sample median
- $Q_1 =$ first quartile
- $S =$ sample standard deviation
- $\bar{X} =$ sample mean

Which of them is least affected by an outlier? (Circle one.)

i. $IQR$, $M$, and $Q_1$
ii. $IQR$ and $S$
iii. $M$ and $\bar{X}$
iv. $S$ and $\bar{X}$
v. None of the above

(b) R was used to get summary statistics on data on the average commute time (in minutes) for each of 51 states (or, rather, 50 states and the District of Columbia):

```r
commute = c(15.2, 15.4, 16.5, 16.9, 17.5, 17.5, 17.5, 18.1, 18.9, 19.1, 19.4, 19.5, 19.7,
            19.9, 20.3, 20.4, 21, 21.2, 21.6, 21.7, 21.8, 21.8, 22.1, 22.1, 22.5, 22.6,
            22.7, 22.7, 22.9, 23, 23.2, 23.3, 23.3, 23.4, 23.4, 23.6, 23.7, 23.8, 24.5,
            24.6, 24.7, 24.8, 24.8, 25.8, 26, 26.1, 26.5, 27, 28.4, 28.5, 30.2, 30.4)
> summary(commute)
   Min. 1st Qu.  Median    Mean 3rd Qu.   Max.   
  15.20  20.10  22.70  22.43  24.55  30.40
```

What is the interquartile range (IQR) of the commute times? (Hint: You do not need to use the raw data.)

(c) Find the third quartile of this set of spruce log lengths (in feet):

8.7 9.2 8.7 8.0 8.5 10.1 7.5 7.8 8.8 8.0
3. (20 points) In a sample of 100 shipping boxes, the sample mean compressive strength was 6000 N. The population standard deviation was known, from prior experience, to be 200 N.

(a) Find a 95% confidence interval for the mean compressive strength, expressed as “center ± error margin”.

(b) Approximately how many boxes must be sampled so that a 95% confidence interval will specify the mean to within ±25 N?

(c) Nobel economist Daniel McFadden worked on the Council of Economic Advisors for President Lyndon Johnson. When McFadden offered a range of forecasts for economic growth, the President replied, “Ranges are for cattle; give me one number.” What confidence level is associated with a confidence interval whose error margin is 0?
4. (10 points) Suppose each ticket in a lottery has a $\frac{1}{8}$ chance of being a winner. What is the probability of having exactly 4 winners in a randomly selected group of 10 tickets?

5. (20 points) A class of students took a quiz whose score distribution is in the table below.

<table>
<thead>
<tr>
<th>score</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>prop.</td>
<td>$0$</td>
<td>$\frac{1}{8}$</td>
<td>$\frac{3}{8}$</td>
<td>$\frac{1}{2}$</td>
</tr>
</tbody>
</table>

(a) What is the mean score?

(b) What is the variance of the scores?
6. (20 points) A grandmother will put a pile of money into two uncertain investments:

- a stock whose return has a mean of 6% and a standard deviation of 1%
- a bond whose return has a mean of 4% and a standard deviation of 0.5%

Suppose she puts half her money in the stock and half in the bond. Let $R_s = \text{the return on the stock}$ and $R_b = \text{the return on the bond}$ (each as a percentage). Then $R = \text{her return} = \frac{1}{2}R_s + \frac{1}{2}R_b = \frac{1}{2}(R_s + R_b)$.

(a) What is the expected value of her return?

(b) What is the standard deviation of her return?