Print Name: Key

Math 127 – Exam 2 – Spring 2017

Version ~~Dr. Dre~~ Yin

PROBABILITY PART

Oath: ***"I will not discuss the exam contents with anyone on planet Earth until the answer key is posted to Blackboard."***

Sign Name: ______________________________

The penalty for cheating on this Exam is a grade of 0% for Math 127 Exam 2.

Student Instructions

1. **This test is graded out of 50 points and counts for 10% of your Math 127 grade. There are 32 questions worth 1.5 points each and 6f is worth 2 points.**

2. **You can use a calculator, but you cannot use your phone. You can use the calculator on the computers if you wish.**

3. **You will need to use www.statcrunch.com. This is the <u>only</u> permitted webpage.**

4. **You are permitted to use one 8.5" by 11" sheet of notes, front and back. You will submit it with your test.**

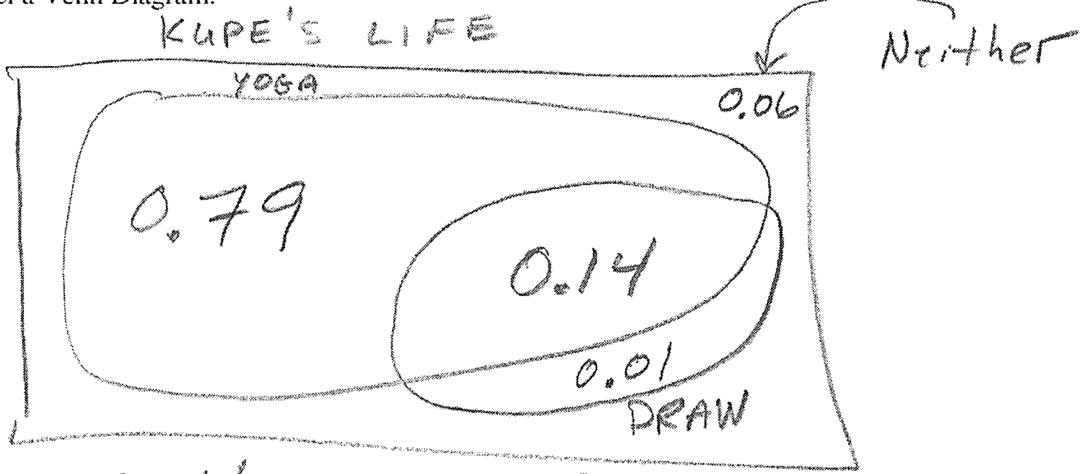
   You may <u>not</u> use the pink sheet or copies of the pink sheet.

   You must produce (handwritten or typed up) your own sheet of notes.

   You may <u>not</u> use copies or scans of any instructor-created Math 127 content or answer keys.

5. **Show work or points will be deducted. If you only report an answer and it is wrong, you will receive no credit.**

1a. Professor Kupe draws on 15% of his days, goes to yoga on 93% of days, and on 14% of days he does both. Draw and label a Venn Diagram.



1b. P(Yoga | Draws) = $0.14/0.15 = 0.9333$

1c. P(Draws | Yoga) = $0.14/0.93 = 0.1505$

1d. Presuming days are independent of each other, use a Binomial distribution to determine the probability that during a 31-day month, he goes to yoga at least 28 times.

Answer: $P(X \geq 28) = 0.8313$ $n = 31,\ p = 0.93$

1e. Presuming days are independent of each other, use a Binomial distribution or another method to determine the probability that during a 31-day month, he draws at least one time.

Answer: $P(X \geq 1) = 0.9935$ $n = 31,\ p = 0.15$

OR P(Draw at least once) =

1 − P(does not draw) =

1 − P(31 for 31 not draw) = $1-(0.85)^{31}$

$= 0.9935$

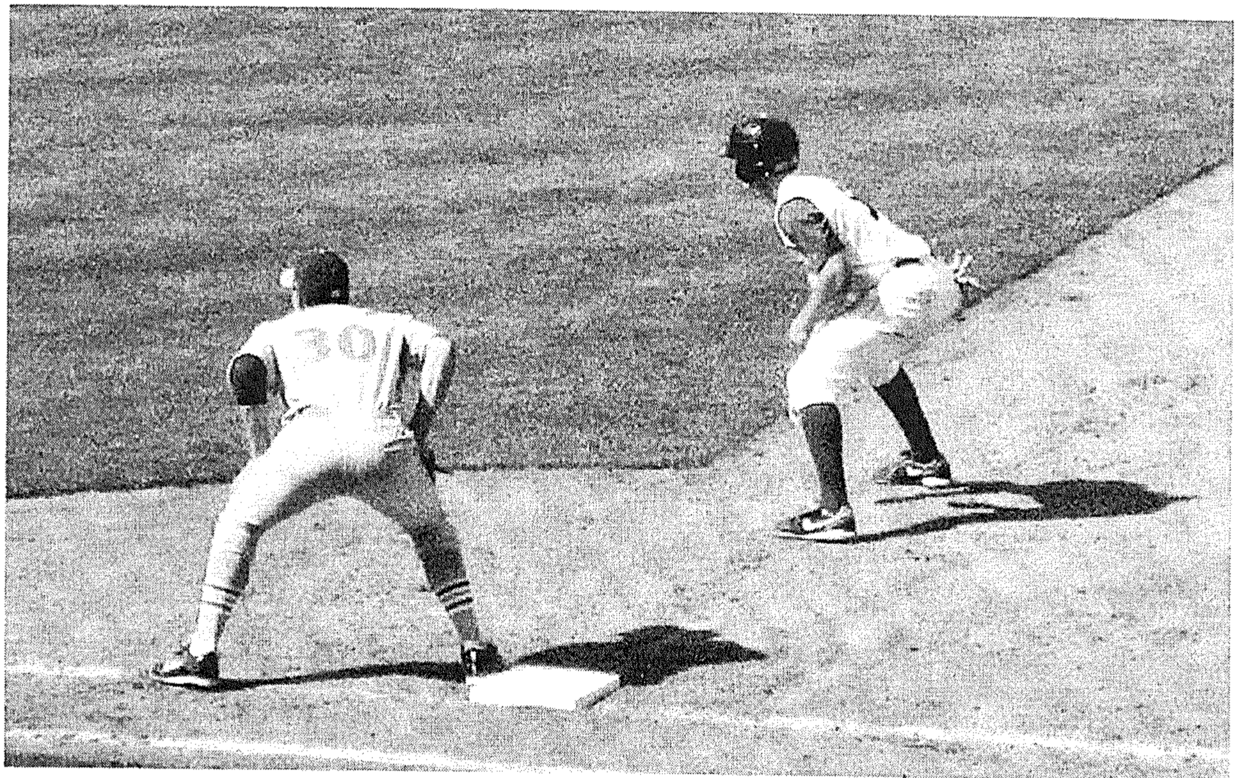
1f. Presuming days are independent, show the calculation for:

P(Both days on a weekend he does both activities) =

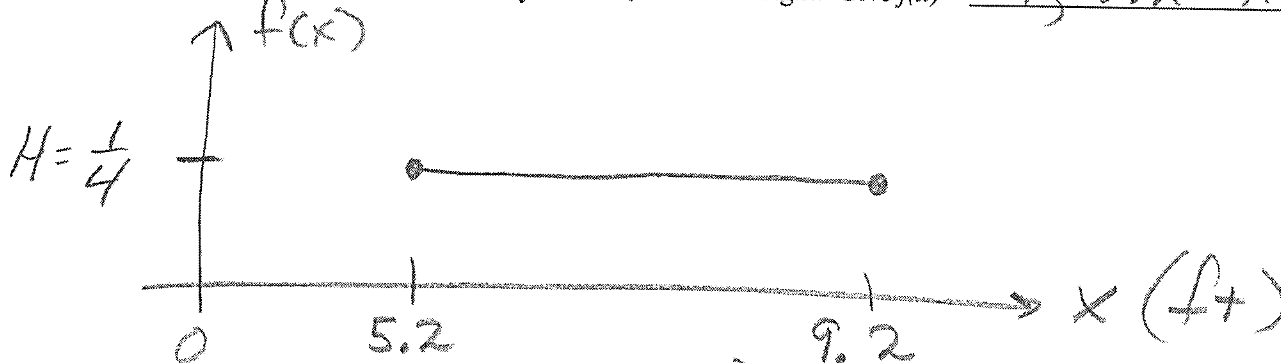
P(2 for 2 does both) = $(0.14)^2$

$= \underline{0.0196}$

2. Suppose the amount of lead a baserunner takes is Uniformly distributed on the interval [5.2 feet, 9.2 feet].



2a. Draw the Uniform model. Label your axes, label the height. Give $f(x) =$ $\frac{1}{4},\ 5.2 \le x \le 9.2$



2b. P(Runner leads off at least 7 feet) = $P(X \geq 7) = 0.55$

2c. The 10^{th} percentile is 5.6 ft. This means 10% of the time, the leadoff is 5.6 ft or less. 90% of the time it is larger.

2d. How big of a lead do we expect this baserunner to take? Show calculation:

$$\mu = \frac{a+b}{2} = \frac{5.2 + 9.2}{2} = 7.2 \text{ ft.}$$

3. The following gambling game has been cooked up by the author of this exam. You will draw a card from a fair deck of 52 cards. We always shuffle up the entire deck for every turn.

Outcome	Prize (+) or Payment Owed (–)	Probability
Ace	$100	4 / 52
King	$75	4 / 52
Queen	$50	4 / 52
Jack	$25	4 / 52
10 or below	–$25	36 / 52

In other words, if you draw a 10, 9, …, 3, 2, you owe $25. Get a face card or an ace, and you win money.

3a. On any turn, what is the P(Win at least $50) = $12/52 = 0.2308$

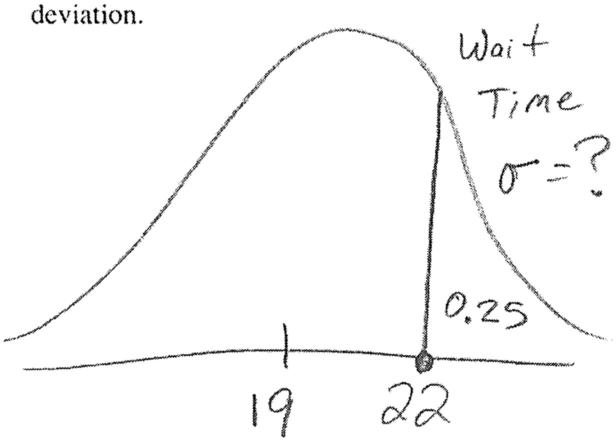
3b. Play five times. Lose money on all five turns. What is the probability of that, show the calculation:

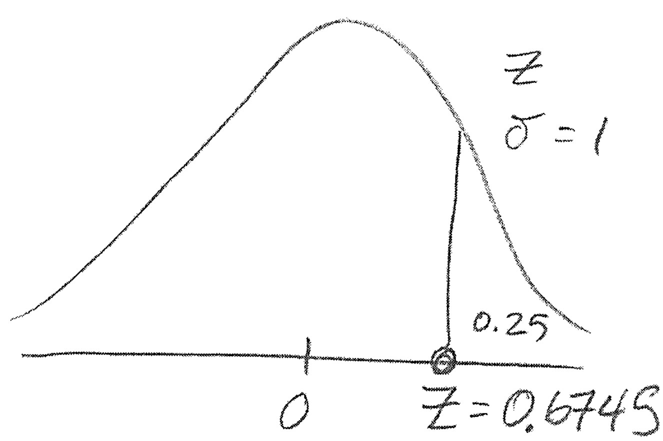
$$P(5 \text{ for } 5 \text{ lose}) = (36/52)^5$$
$$= 0.1590$$

3c. Calculate the expected amount won / lost when playing this game. Show calculation:

$$\mu = 100(4/52) + 75(4/52) + 50(4/52)$$
$$+ 25(4/52) - 25(36/52) = \$1.92$$

4. Time to wait for an elevator at The Palisades apartments in Towson follows a Normal distribution with a mean of 19 seconds but an unknown standard deviation. Professor Kupe collected some data, and 25% of the wait times took 22 seconds or longer. Show the calculations / Normal models to determine the missing standard deviation.





$$Z = \frac{y-\mu}{\sigma}, \quad 0.6745 = \frac{22-19}{\sigma}, \quad \sigma = 4.45 \text{ sec.}$$

5. Time between someone entering or leaving the front door of the Palisades Apartments (during typical business hours) follows an Exponential probability model with a mean of 1.5 minutes.

5a. P(No one enters or leaves for at least 5 minutes) = $P(X \geq 5) = 0.0357$

5b. P(Someone arrives or leaves in the next 5 seconds) = $P(X \leq 5/60) = 0.0540$

5c. Determine the 90[th] percentile: 3.45 mins.

207 secs.

6. Rasmussen Reports from March 27, 2017 claims that $p = 29\%$ of Americans "***Strongly Approved***" of Trump's presidency. Presuming that figure holds here at the college, we will survey $n = 10$ students randomly from our student population.

6a. P(At most 1 student "***Strongly Approves***" of Trump) = $P(X \leq 1) = 0.1655$

(0.1337)

6b. P(A majority "***Strongly Approve***" of Trump) = $P(X > 5) = P(X \geq 6) = 0.0404$

6c. P(Exactly 3 students "***Strongly Approve***" of Trump) = $P(X=3) = 0.2662$

6d. Calculate the mean and show the calculation:

$$\mu = np = 10(0.29) = 2.9$$

6e. Calculate the standard deviation and show the calculation:

$$\sigma = \sqrt{np(1-p)} = \sqrt{10(0.29)(0.71)} \approx 1.435$$

6f. Using your mean and standard deviation from above, would it be unusual or not unusual if the following numbers of students "***Strongly Approved***" of Trump? Circle each. (0.2 points each)

0 Strongly Approved	Unusual	Not Unusual
1 Strongly Approved	Unusual	Not Unusual
2 Strongly Approved	Unusual	Not Unusual
3 Strongly Approved	Unusual	Not Unusual
4 Strongly Approved	Unusual	Not Unusual
5 Strongly Approved	Unusual	Not Unusual
6 Strongly Approved	Unusual	Not Unusual
7 Strongly Approved	Unusual	Not Unusual
8 Strongly Approved	Unusual	Not Unusual
9 Strongly Approved	Unusual	Not Unusual
10 Strongly Approved	Unusual	Not Unusual

$\mu \pm 2\sigma$

$2.9 \pm 2(1.435)$

$(0.03, 5.77)$

Not Unusual Range.

7. 16-pound bowling balls have weights that follow a Normal model with a mean of 15.97 pounds and a standard deviation of 0.12 pounds.

7a. Determine the probability that a randomly selected ball weighs over 16 pounds. Answer: 0.4013

7b. Determine the probability a ball weighs in within 0.05 pounds of the stated 16-pounds.

Answer: 0.3137 within (15.95, 16.05)

7c. Determine the probability that a ball weighs in within two standard deviations of the mean of 15.97 pounds.

Answer: 0.95 or 0.9545

7d. Four random bowling balls are pulled off the rack. Calculate the probability that at least one of them is over 16 pounds.

$n = 4$, $p = 0.4013$, $P(X \geq 1) = \underline{0.8715}$

OR P(At least one over 16 lbs) =

1 − P(4 for 4 are under 16) =

$1 - (0.5987)^4 = \underline{0.8715}$

8. Calculate the probability of winning on at least one scratch off lottery ticket if the chance of winning on any ticket is 40% and you buy 5 tickets.

$n = 5$, $p = 0.40$, $P(X \geq 1) = \underline{0.9222}$

OR P(win at least once) = 1 − P(5 for 5 lose)

$= 1 - (0.6)^5 = \underline{0.9222}$

9. The following table will be used to estimate probabilities for Cecil College.

Rows: Gender
Columns: Worst Problem

	Artificial intelligence	Disease Epidemic	Global Warming	Non-renewable energy	Over-population	Something Else	Terrorism	Total
Female	9	15	21	8	26	26	50	155
Male	7	4	9	5	15	18	20	78
Total	16	19	30	13	41	44	70	233

9a. P(Terrorism) = 70/233 = 0.3004

9b. P(Over Population | Male) = 15/78 = 0.1923

9c. P(Female | Global Warming) = 21/30 = 0.7

9d. P(Male and said Artificial Intelligence) = 7/233 = 0.0300