

NAME:

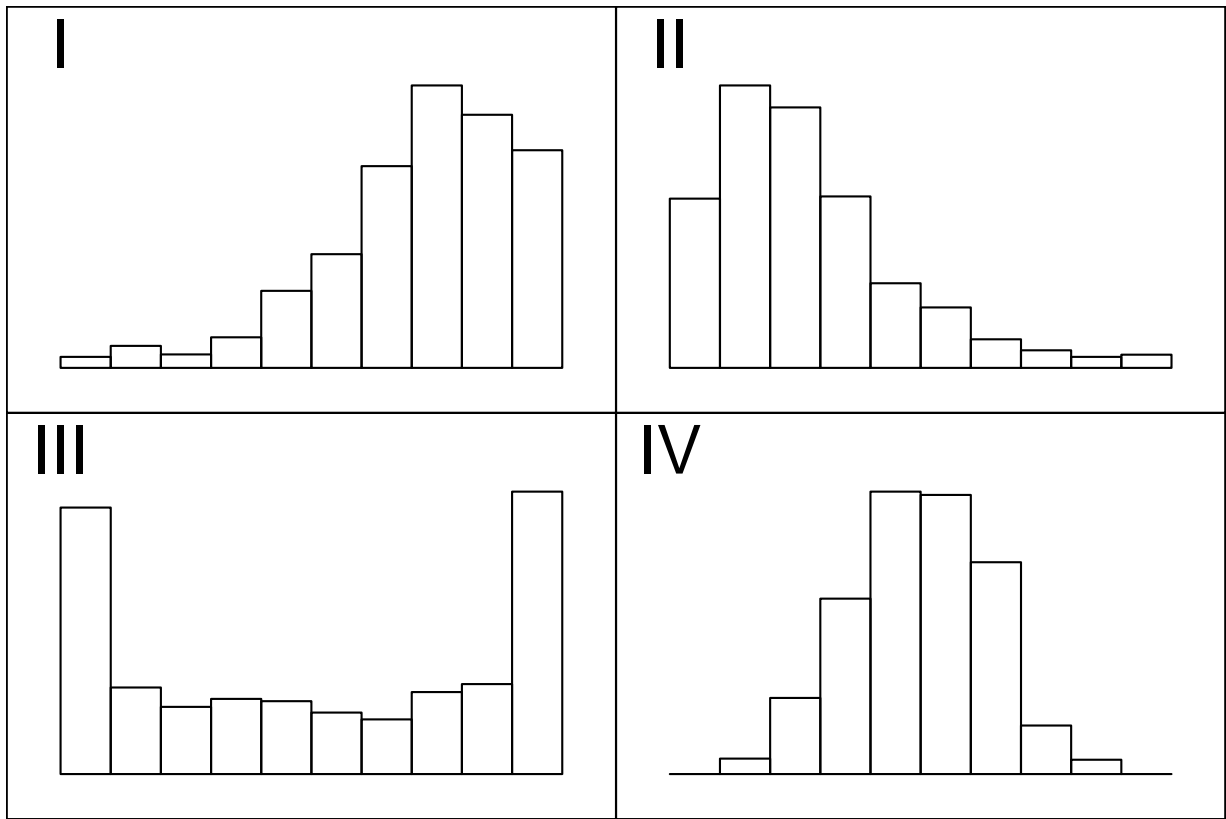
FINAL VERSION 001

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of lengths of newborn babies
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (d) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.

2. (15 Points)

In a deck of strange cards, there are 709 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	blue	green	red	teal	Total
gem	26	45	16	25	40	152
kite	39	15	12	30	36	132
quilt	27	18	35	23	31	134
shovel	14	46	34	37	49	180
tree	10	19	21	41	20	111
Total	116	143	118	156	176	709

- (a) What is the probability a random card is red?
- (b) What is the probability a random card is either a shovel or black (or both)?
- (c) What is the probability a random card is teal given it is a tree?
- (d) What is the probability a random card is a kite given it is blue?
- (e) What is the probability a random card is a tree?
- (f) Is a gem or a quilt more likely to be green?
- (g) What is the probability a random card is both a quilt and red?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	127	8
<i>B</i>	86	6
<i>C</i>	145	13
<i>D</i>	124	9

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	128
<i>B</i>	85.22
<i>C</i>	138.4
<i>D</i>	129.5

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 55.9 millimeters and a standard deviation of 9.3 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 57.9 and 62.6 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 296.6 grams and a standard deviation of 12 grams. A researcher plans to measure the weights of 36 of these ducks sampled randomly. What is the probability the **sample mean** will be between 299.1 and 301.1 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus fuscescens*. She randomly samples 27 adults of *Catharus fuscescens*, resulting in a sample mean of 41.96 grams and a sample standard deviation of 5.09 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 400 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 116 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
23	4.1	
94	7.5	
32	5.7	
25	4.7	
59	5.4	
10	3.3	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

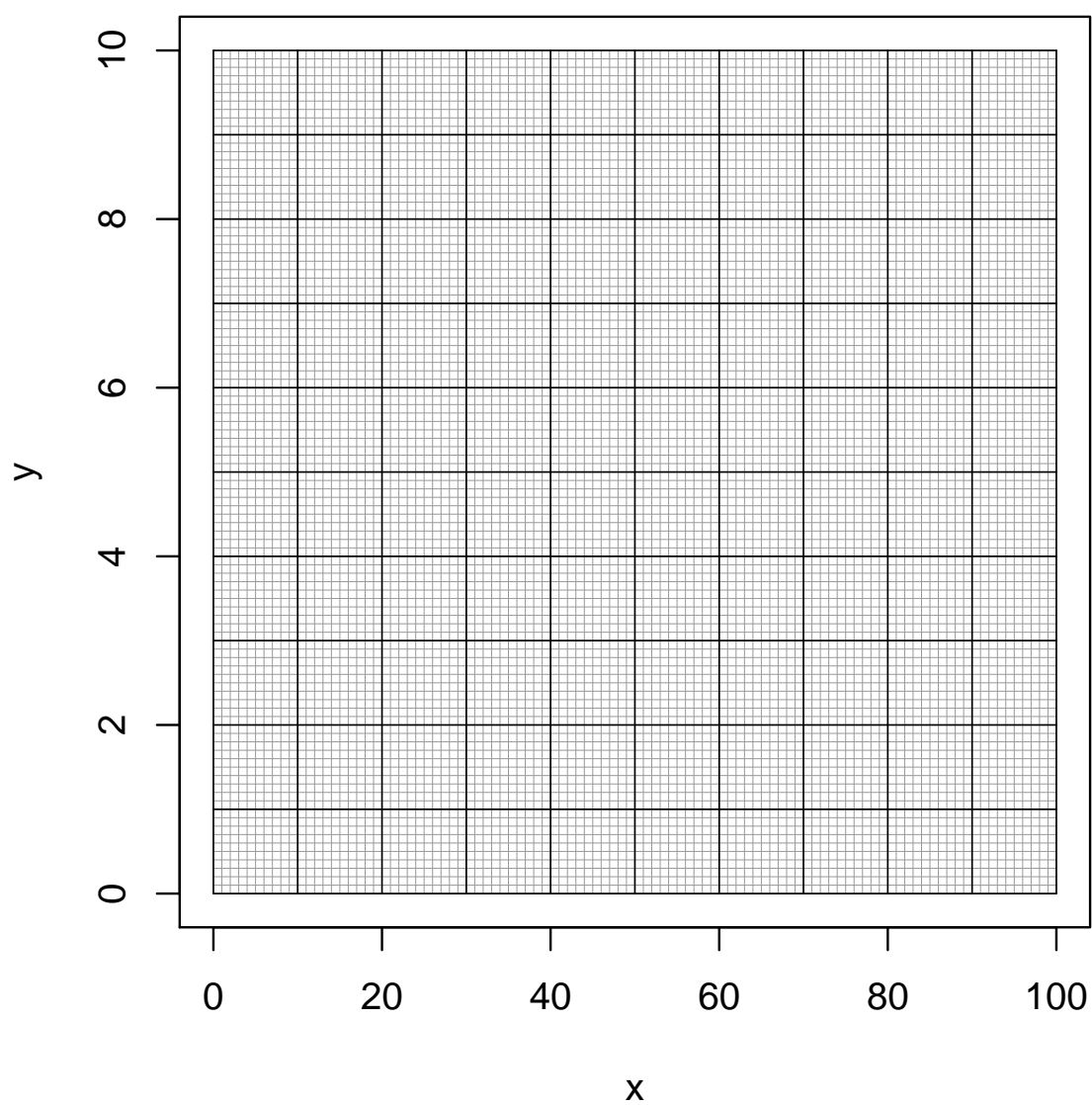
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.51$. If 111 trials occur, what is the probability of getting more than 48 but at most 55 successes?

In other words, let $X \sim \text{Bin}(n = 111, p = 0.51)$ and find $P(48 < X \leq 55)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 80$. You decide to run two-tail test on a sample of size $n = 10$ using a significance level $\alpha = 0.05$.

You then collect the sample:

89.3	71.8	89.8	92.1	93.7
75.8	72.4	100.1	120.5	96.4

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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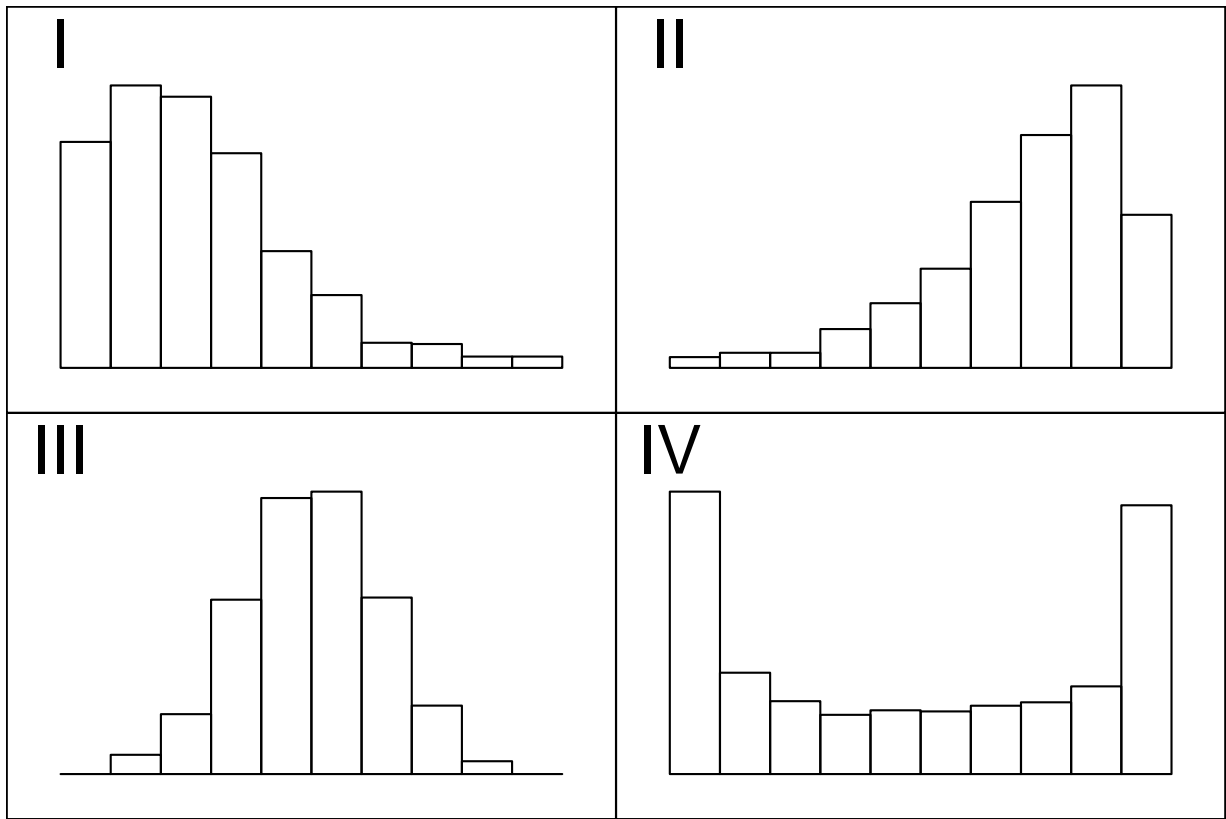
FINAL VERSION 002

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (b) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (c) The distribution of heights of adult men
- (d) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.

2. (15 Points)

In a deck of strange cards, there are 776 cards. Each card has an image and a color. The amounts are shown in the table below.

	green	orange	violet	white	yellow	Total
bike	41	16	35	48	49	189
dog	44	19	50	34	29	176
flower	37	38	47	15	20	157
gem	36	43	24	14	42	159
wheel	12	21	25	27	10	95
Total	170	137	181	138	150	776

- (a) What is the probability a random card is violet?
- (b) What is the probability a random card is a flower given it is yellow?
- (c) What is the probability a random card is green given it is a bike?
- (d) What is the probability a random card is a bike?
- (e) What is the probability a random card is either a gem or violet (or both)?
- (f) What is the probability a random card is both a wheel and orange?
- (g) Is a dog or a gem more likely to be white?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	91	9
<i>B</i>	99	6
<i>C</i>	62	13
<i>D</i>	97	15

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	90.82
<i>B</i>	103.1
<i>C</i>	72.79
<i>D</i>	97.45

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 138 millimeters and a standard deviation of 9.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 116.2 and 121.9 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 178.1 grams and a standard deviation of 33 grams. A researcher plans to measure the weights of 121 of these ducks sampled randomly. What is the probability the **sample mean** will be between 170.6 and 179.6 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Ammodramus maritimus*. She randomly samples 30 adults of *Ammodramus maritimus*, resulting in a sample mean of 21.68 grams and a sample standard deviation of 1.57 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 1000 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 529 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
4.4	2.9	
5.3	2.5	
7.2	1.9	
5.7	2.1	
6.8	4.7	
2.8	5.6	
2.8	3	
3.3	6.8	
4.9	2.7	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

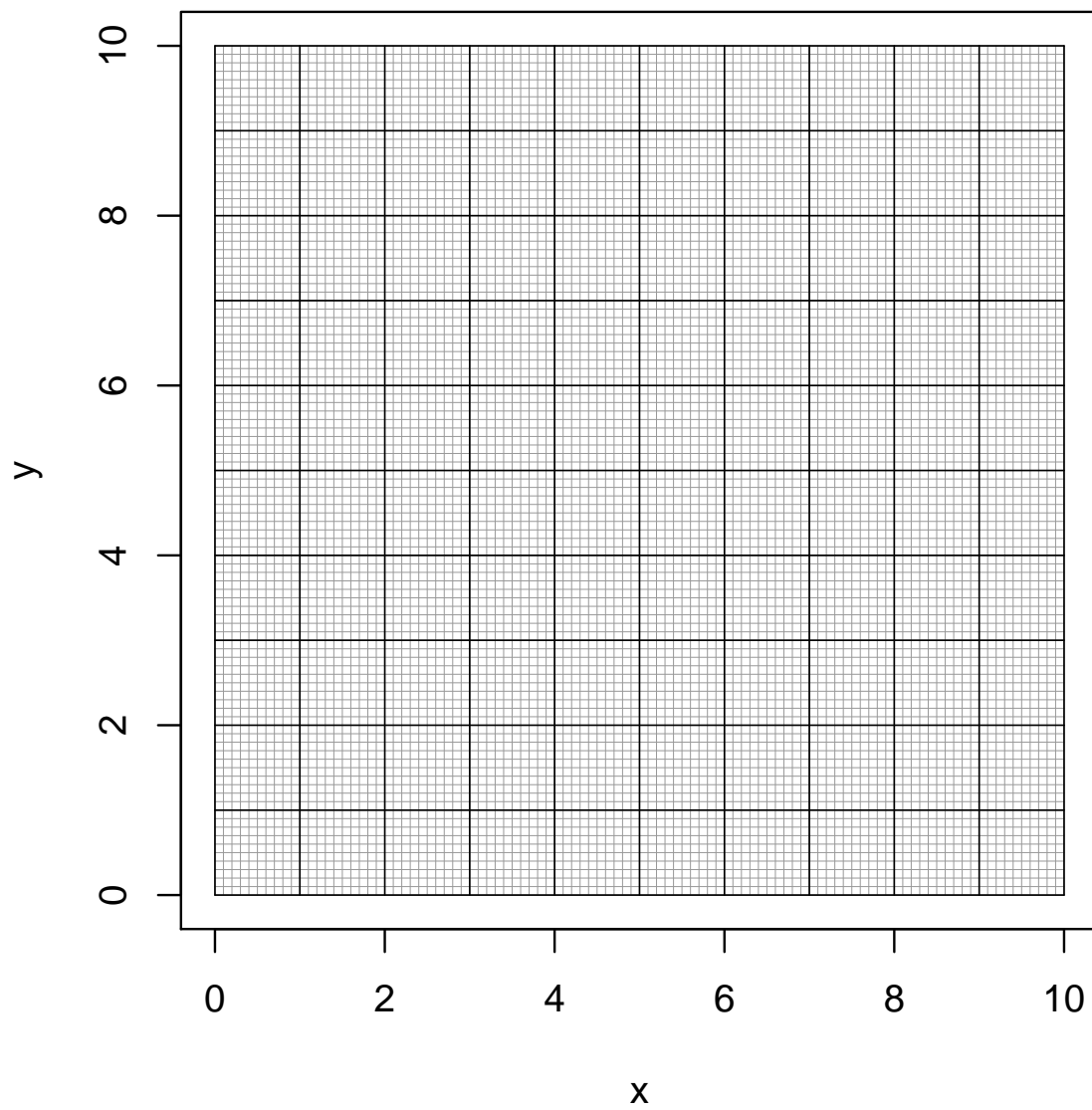
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.44$. If 158 trials occur, what is the probability of getting more than 58 but at most 70 successes?

In other words, let $X \sim \text{Bin}(n = 158, p = 0.44)$ and find $P(58 < X \leq 70)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 130$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.05$.

You then collect the sample:

191.9	145	133.6	126.4	106.6
147.6	176	109	188.3	200.1
145.2				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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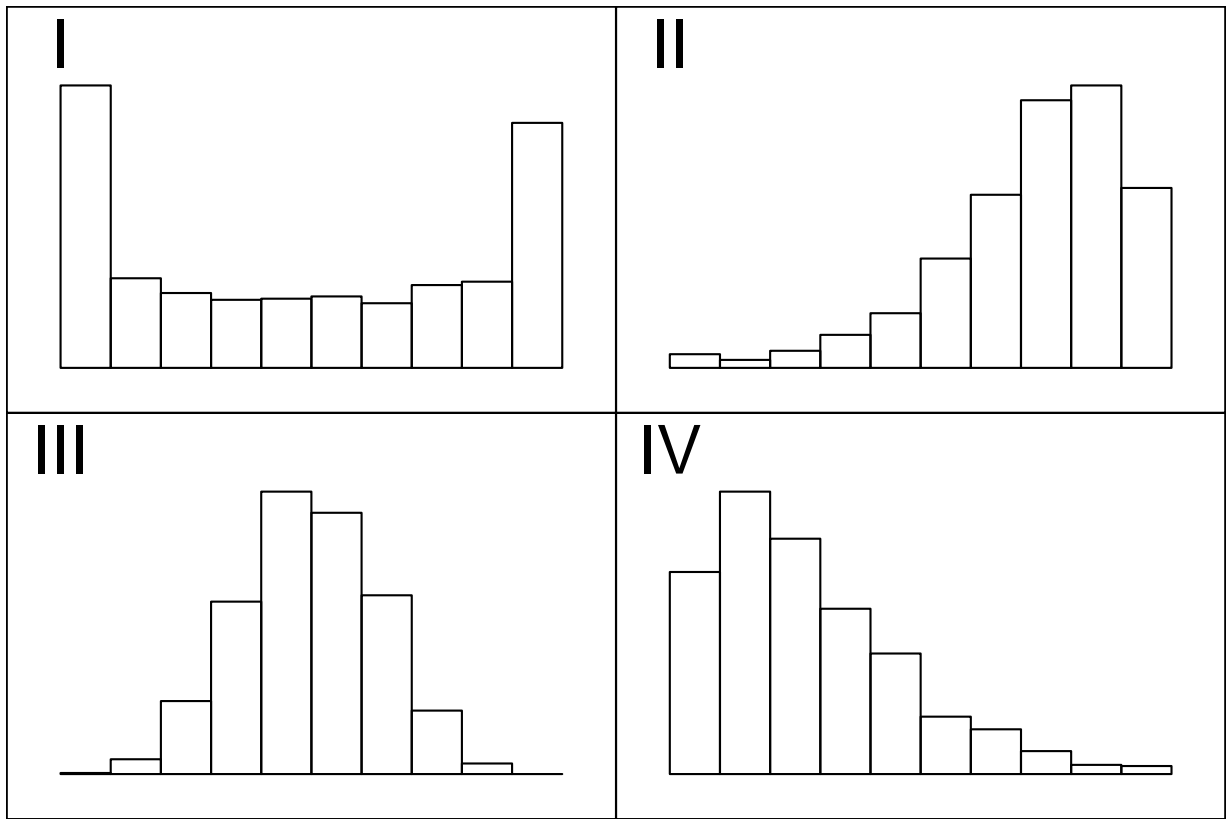
FINAL VERSION 003

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (b) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (c) The distribution of weights of newborn babies
- (d) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.

2. (15 Points)

In a deck of strange cards, there are 674 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	blue	gray	yellow	Total
gem	34	25	20	18	97
needle	46	38	40	47	171
rug	49	19	27	39	134
shovel	30	42	44	48	164
tree	33	12	13	50	108
Total	192	136	144	202	674

- (a) What is the probability a random card is both a tree and gray?
- (b) What is the probability a random card is a needle?
- (c) What is the probability a random card is black given it is a gem?
- (d) What is the probability a random card is black?
- (e) Is a needle or a shovel more likely to be gray?
- (f) What is the probability a random card is either a tree or blue (or both)?
- (g) What is the probability a random card is a gem given it is blue?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	88	15
<i>B</i>	91	13
<i>C</i>	130	5
<i>D</i>	131	12

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	89.35
<i>B</i>	71.24
<i>C</i>	122.4
<i>D</i>	127.2

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 104.1 millimeters and a standard deviation of 7.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 87.9 and 106.7 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 210.6 grams and a standard deviation of 24 grams. A researcher plans to measure the weights of 144 of these ducks sampled randomly. What is the probability the **sample mean** will be between 211.1 and 213.1 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Dendroica coronata*. She randomly samples 22 adults of *Dendroica coronata*, resulting in a sample mean of 11.96 grams and a sample standard deviation of 1.21 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 500 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 142 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
98	13	
49	29	
42	54	
78	32	
89	44	
34	100	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

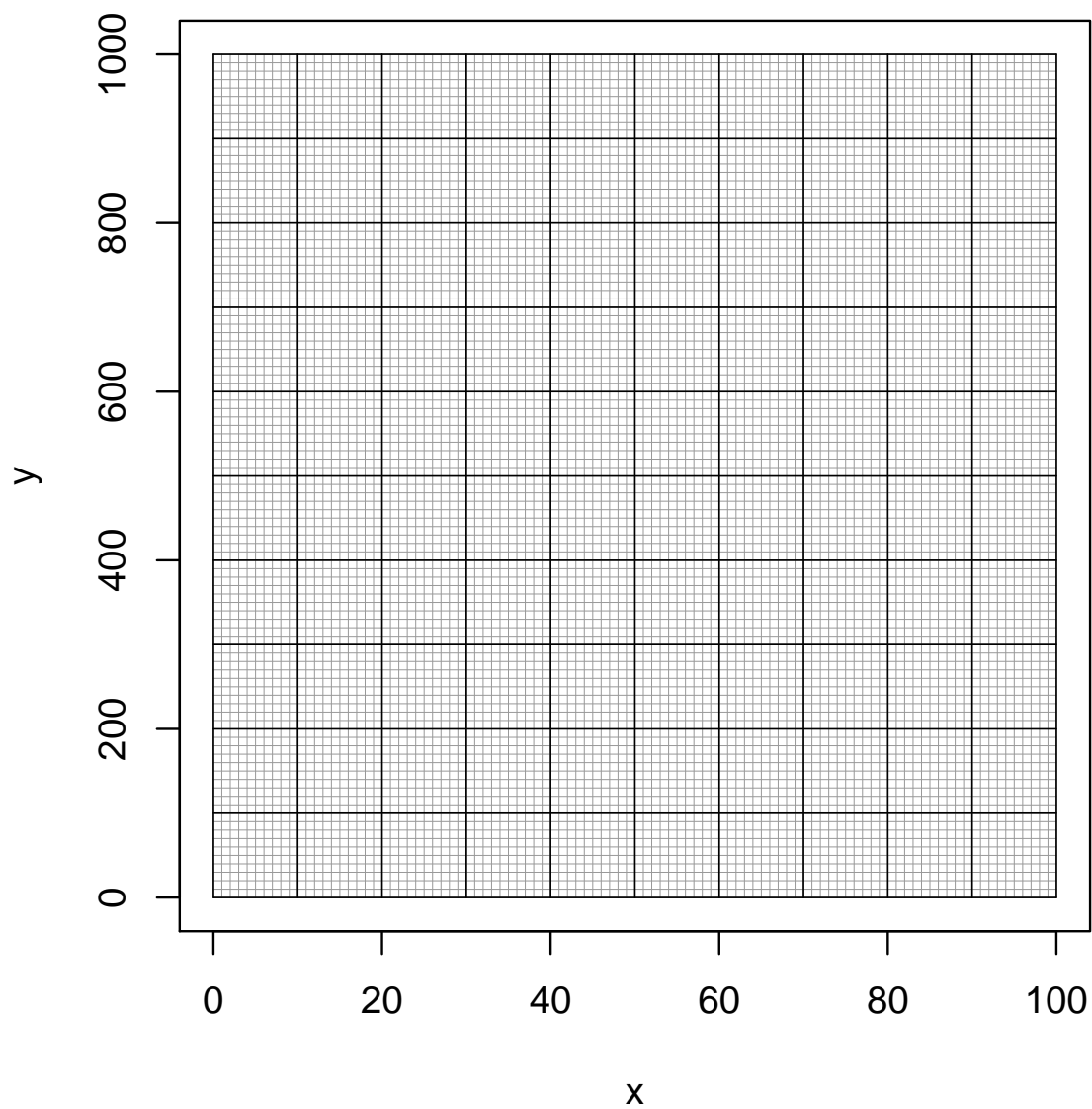
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.16$. If 86 trials occur, what is the probability of getting at least 15 but at most 21 successes?

In other words, let $X \sim \text{Bin}(n = 86, p = 0.16)$ and find $P(15 \leq X \leq 21)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 240$. You decide to run two-tail test on a sample of size $n = 10$ using a significance level $\alpha = 0.01$.

You then collect the sample:

239.5	279.5	346.7	324.2	322.3
297.7	209	258.8	262.8	321.3

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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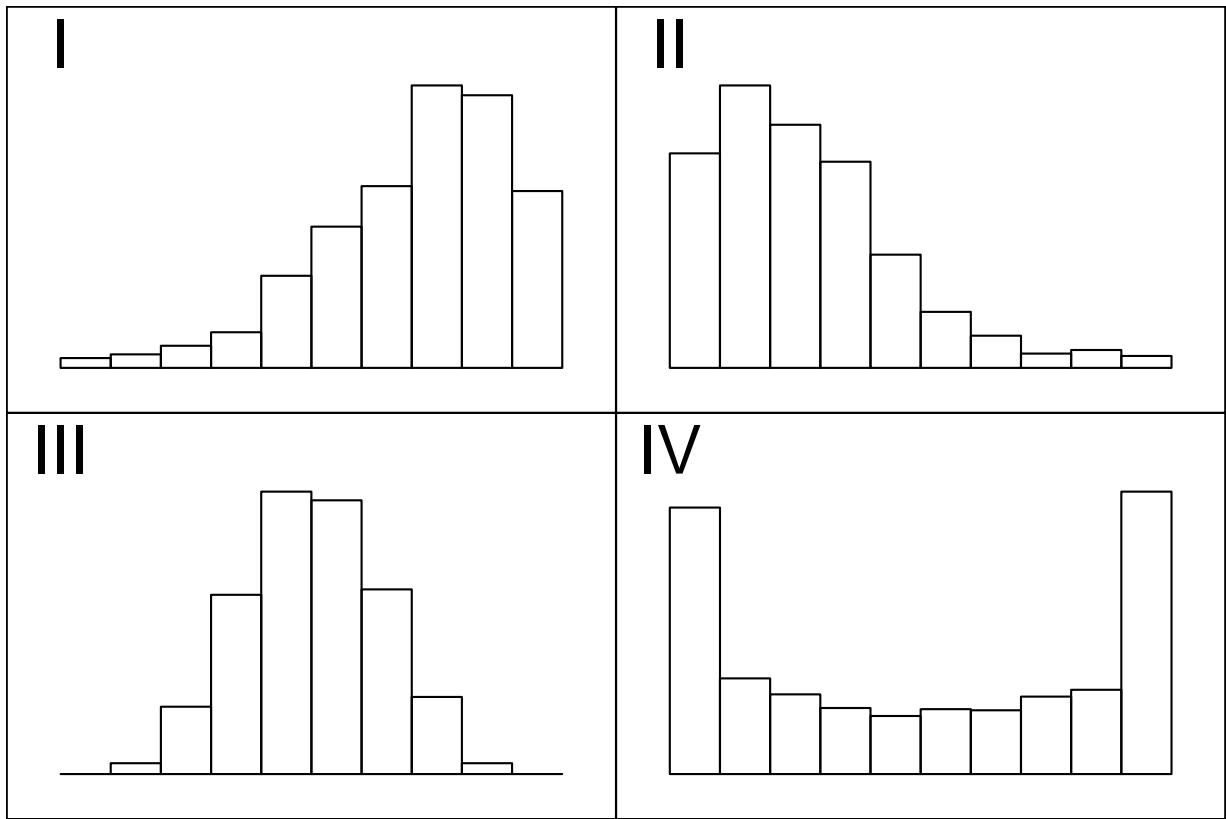
FINAL VERSION 004

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (b) The distribution of lengths of newborn babies
- (c) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (d) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.

2. (15 Points)

In a deck of strange cards, there are 626 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	pink	red	teal	yellow	Total
bike	20	38	10	37	47	152
flower	31	33	14	17	16	111
kite	46	48	34	12	32	172
wheel	24	49	50	39	29	191
Total	121	168	108	105	124	626

- (a) What is the probability a random card is both a wheel and blue?
- (b) What is the probability a random card is a flower given it is pink?
- (c) Is a flower or a kite more likely to be pink?
- (d) What is the probability a random card is red?
- (e) What is the probability a random card is a wheel?
- (f) What is the probability a random card is pink given it is a bike?
- (g) What is the probability a random card is either a kite or teal (or both)?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	84	5
<i>B</i>	104	8
<i>C</i>	139	12
<i>D</i>	134	11

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	91.15
<i>B</i>	101.8
<i>C</i>	148.8
<i>D</i>	130.3

Which specimen is the most unusually large (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 44.3 millimeters and a standard deviation of 2.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 40.3 and 44 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 203.6 grams and a standard deviation of 56 grams. A researcher plans to measure the weights of 64 of these ducks sampled randomly. What is the probability the **sample mean** will be between 210.6 and 214.1 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Dendroica striata*. She randomly samples 17 adults of *Dendroica striata*, resulting in a sample mean of 15.37 grams and a sample standard deviation of 4.09 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 800 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 175 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
9.6	250	
7.6	480	
9.8	410	
7.6	870	
4.6	610	
9.5	450	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

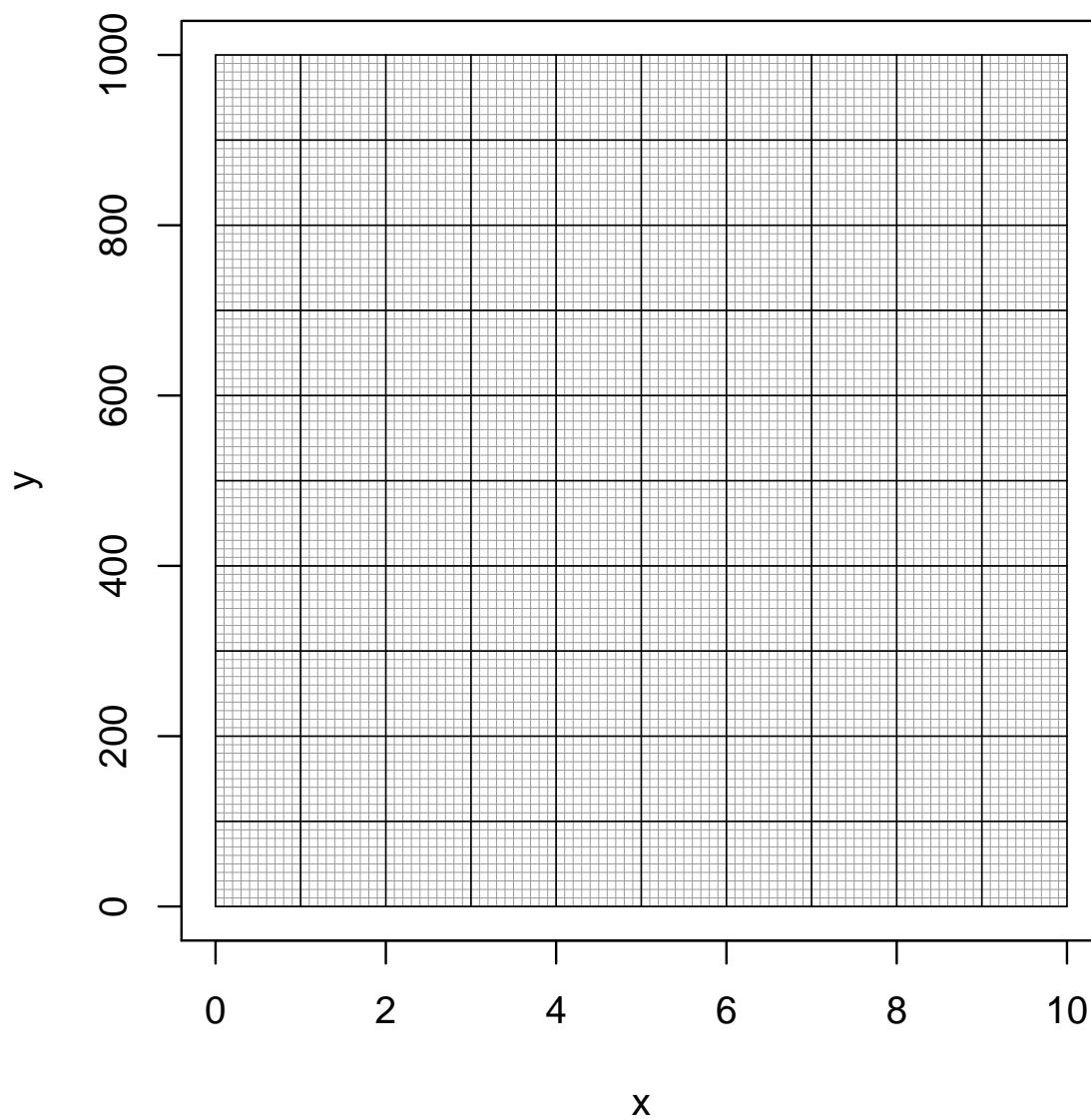
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.71$. If 128 trials occur, what is the probability of getting more than 79 but less than 98 successes?

In other words, let $X \sim \text{Bin}(n = 128, p = 0.71)$ and find $P(79 < X < 98)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 250$. You decide to run two-tail test on a sample of size $n = 12$ using a significance level $\alpha = 0.02$.

You then collect the sample:

299.2	239	261.7	239.3	303.6
302.7	286.2	271.2	233	267.5
288.8	250			

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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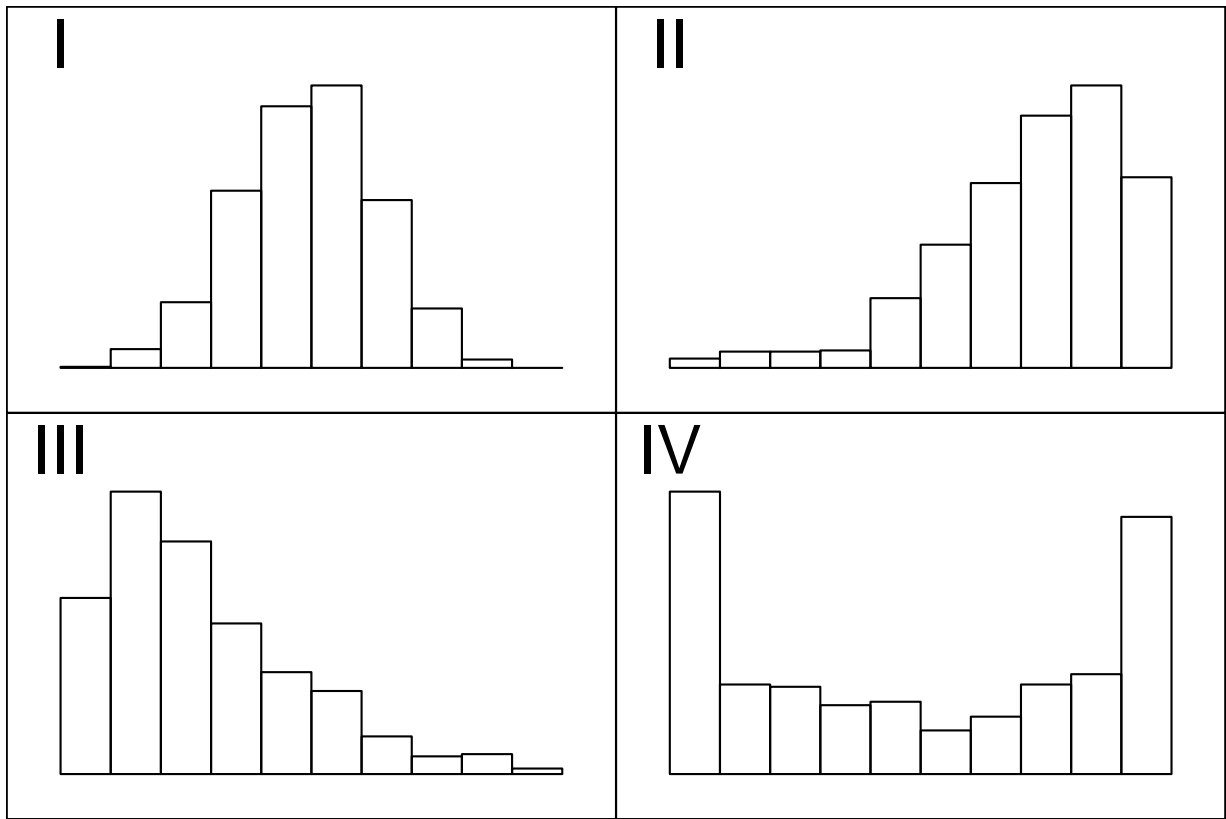
FINAL VERSION 005

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (b) The distribution of weights of newborn babies
- (c) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (d) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.

2. (15 Points)

In a deck of strange cards, there are 352 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	blue	green	Total
kite	25	19	37	81
quilt	40	15	12	67
shovel	36	20	45	101
wheel	30	24	49	103
Total	131	78	143	352

- (a) What is the probability a random card is a shovel given it is black?
- (b) Is a quilt or a wheel more likely to be green?
- (c) What is the probability a random card is blue given it is a wheel?
- (d) What is the probability a random card is both a wheel and blue?
- (e) What is the probability a random card is either a quilt or black (or both)?
- (f) What is the probability a random card is blue?
- (g) What is the probability a random card is a kite?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	119	15
<i>B</i>	60	14
<i>C</i>	104	5
<i>D</i>	131	11

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	128.3
<i>B</i>	67
<i>C</i>	103.8
<i>D</i>	128.6

Which specimen is the most unusually large (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 97.6 millimeters and a standard deviation of 7.6 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 90.2 and 107.3 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 108.3 grams and a standard deviation of 60 grams. A researcher plans to measure the weights of 144 of these ducks sampled randomly. What is the probability the **sample mean** will be between 114.8 and 116.8 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus guttatus*. She randomly samples 20 adults of *Catharus guttatus*, resulting in a sample mean of 28.89 grams and a sample standard deviation of 1.44 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 300 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 86 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
240	7.1	
560	5.1	
180	7.3	
550	5.9	
850	4.4	
130	7.7	
680	4.5	
510	6.4	
160	7.1	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

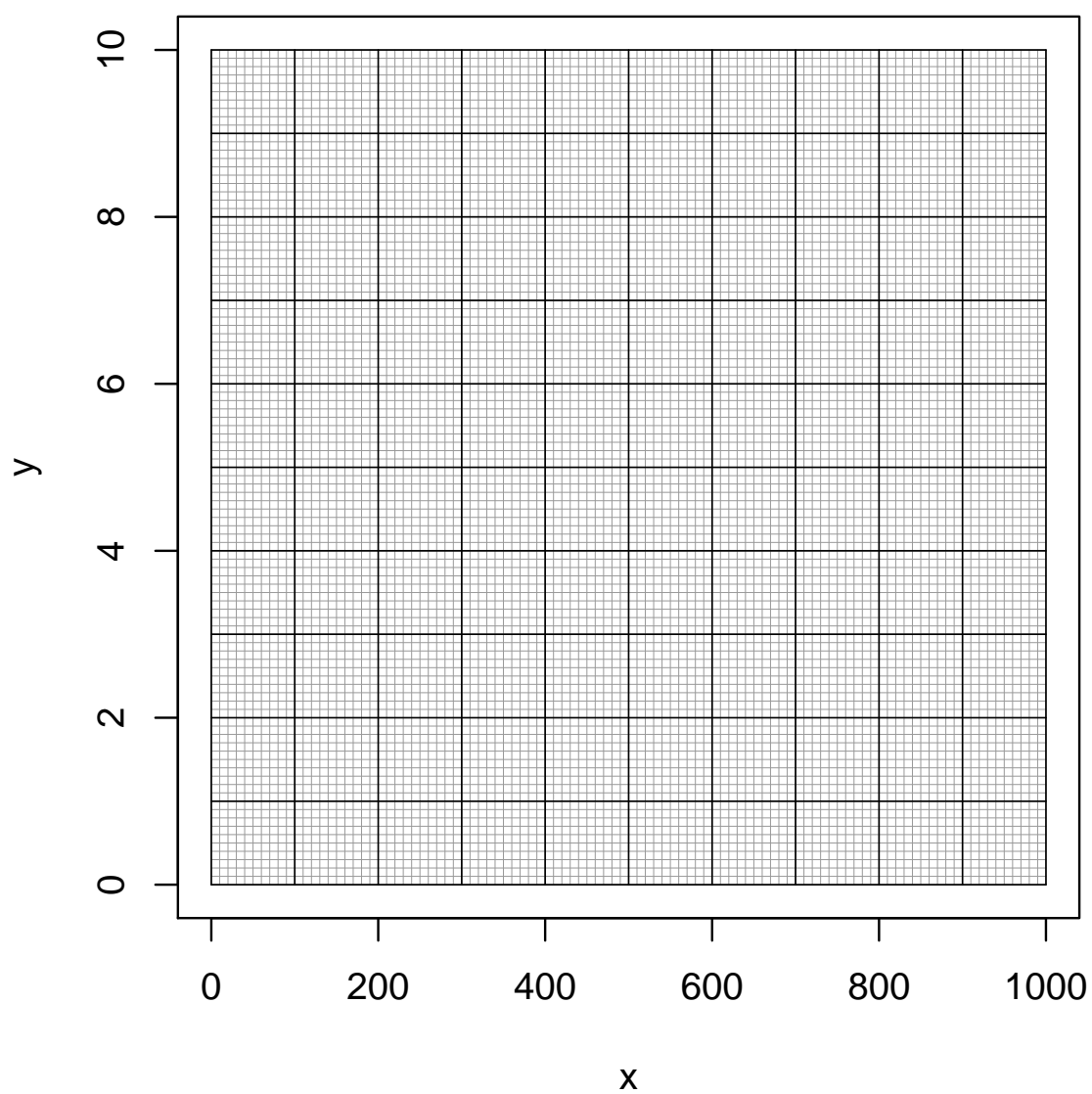
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.34$. If 81 trials occur, what is the probability of getting at least 23 but less than 36 successes?

In other words, let $X \sim \text{Bin}(n = 81, p = 0.34)$ and find $P(23 \leq X < 36)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 180$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.1$.

You then collect the sample:

284.1	159.7	158.1	201.1	185.9
247.6	144	289.4	299.6	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

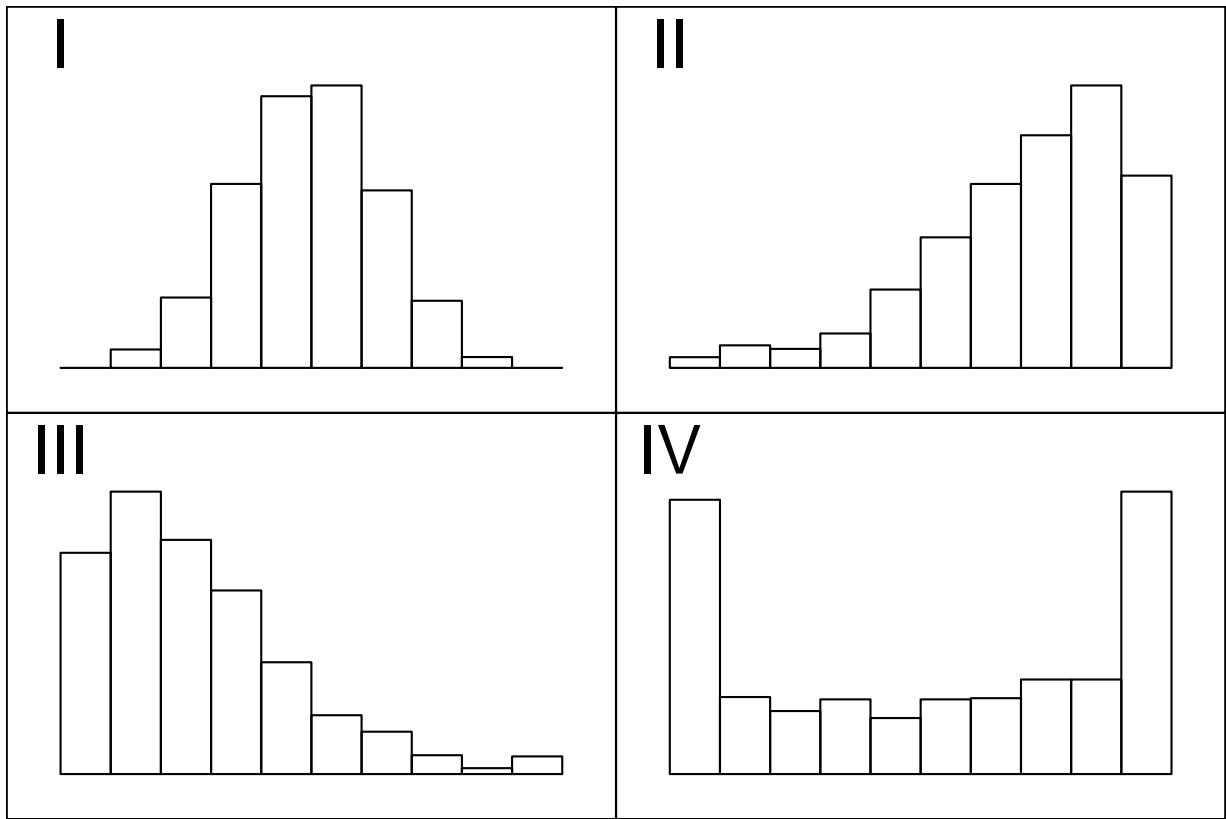
FINAL VERSION 006

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (b) The distribution of lengths of newborn babies
- (c) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (d) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.

2. (15 Points)

In a deck of strange cards, there are 757 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	blue	indigo	orange	red	Total
cat	25	11	38	29	18	121
gem	26	43	50	20	15	154
mop	30	13	12	36	35	126
tree	47	21	14	45	46	173
wheel	33	27	48	34	41	183
Total	161	115	162	164	155	757

- (a) What is the probability a random card is both a mop and blue?
- (b) What is the probability a random card is a gem given it is red?
- (c) What is the probability a random card is either a mop or red (or both)?
- (d) Is a cat or a gem more likely to be indigo?
- (e) What is the probability a random card is orange given it is a mop?
- (f) What is the probability a random card is a gem?
- (g) What is the probability a random card is blue?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	138	15
<i>B</i>	118	7
<i>C</i>	101	8
<i>D</i>	122	5

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	136.5
<i>B</i>	128.8
<i>C</i>	103.4
<i>D</i>	126

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 146.8 millimeters and a standard deviation of 6.8 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 144.2 and 154.1 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 186.3 grams and a standard deviation of 37.5 grams. A researcher plans to measure the weights of 225 of these ducks sampled randomly. What is the probability the **sample mean** will be between 183.8 and 185.8 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Dendroica palmarum*. She randomly samples 31 adults of *Dendroica palmarum*, resulting in a sample mean of 10.15 grams and a sample standard deviation of 1.34 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 500 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 270 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
9.3	4	
7.4	2.9	
1.5	8.2	
3.4	6.3	
9.1	5.2	
5.5	3.1	
2.7	8.6	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

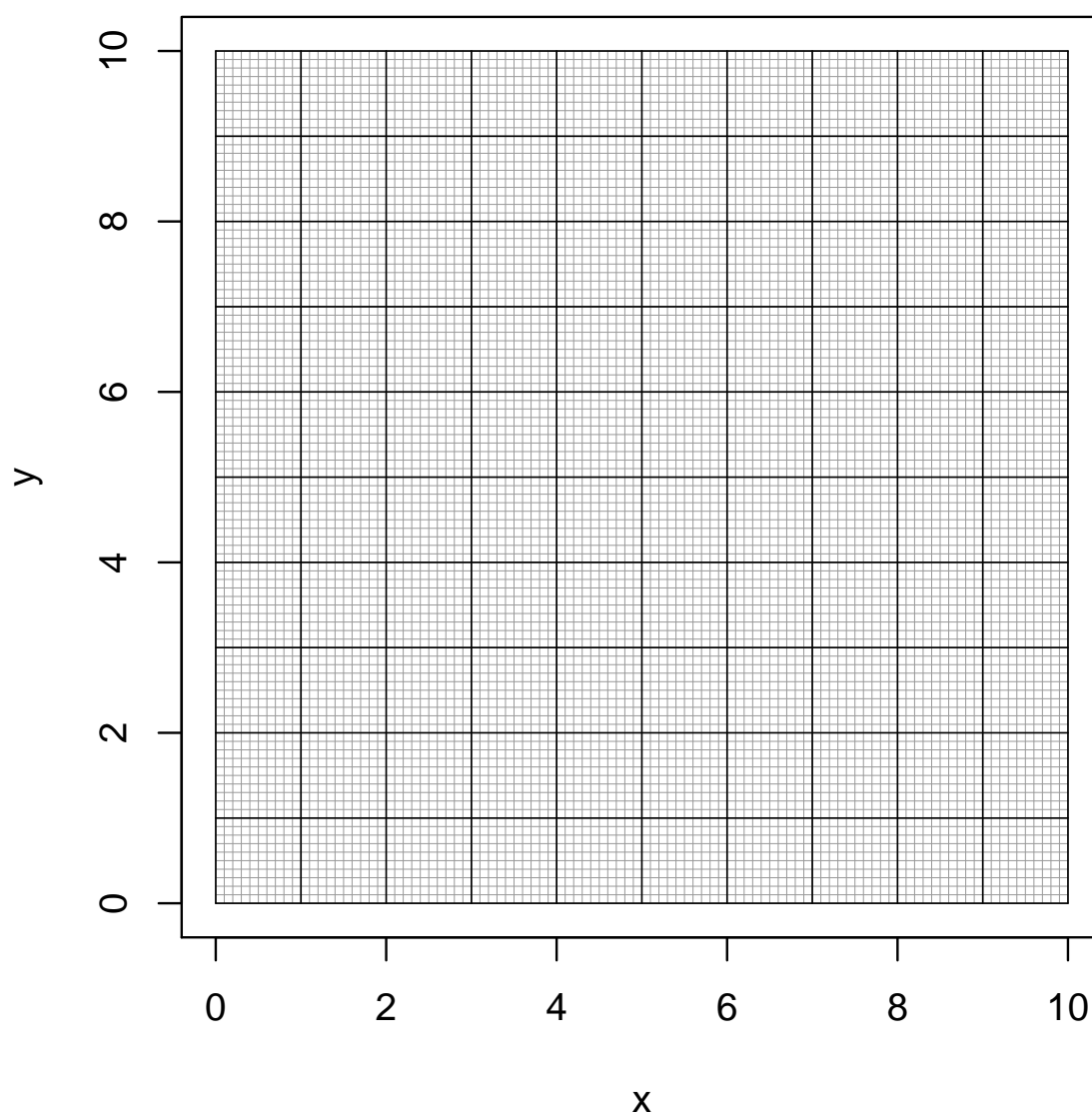
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.83$. If 73 trials occur, what is the probability of getting at least 53 but less than 62 successes?

In other words, let $X \sim \text{Bin}(n = 73, p = 0.83)$ and find $P(53 \leq X < 62)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 210$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.1$.

You then collect the sample:

202	247.4	277	253.7	279.4
280.8	217.1	190.7	168	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

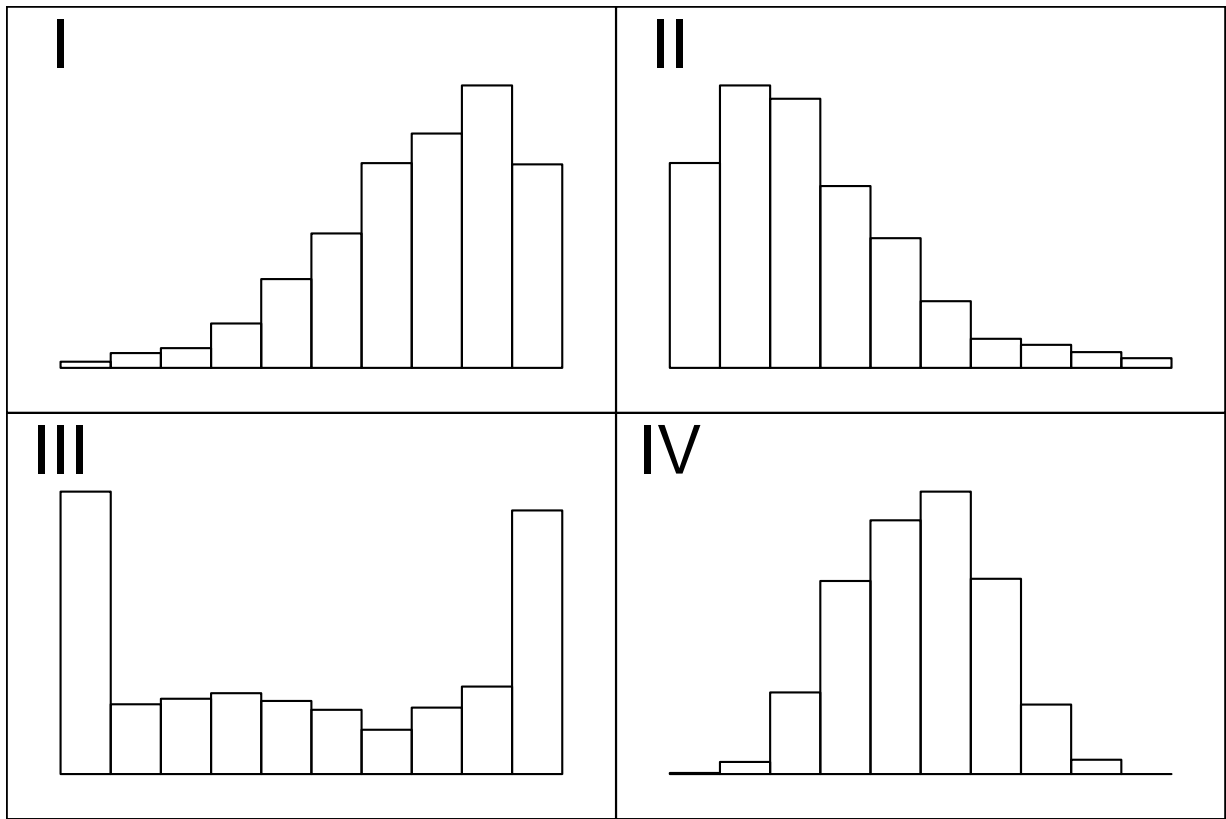
FINAL VERSION 007

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of heights of adult women
- (b) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (c) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (d) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.

2. (15 Points)

In a deck of strange cards, there are 361 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	green	indigo	pink	Total
bike	14	13	24	47	98
jigsaw	29	48	28	12	117
shovel	22	43	32	49	146
Total	65	104	84	108	361

- (a) What is the probability a random card is pink given it is a shovel?
- (b) Is a bike or a shovel more likely to be pink?
- (c) What is the probability a random card is a jigsaw given it is green?
- (d) What is the probability a random card is either a bike or gray (or both)?
- (e) What is the probability a random card is indigo?
- (f) What is the probability a random card is a jigsaw?
- (g) What is the probability a random card is both a bike and indigo?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	113	10
<i>B</i>	96	4
<i>C</i>	125	11
<i>D</i>	104	14

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	105.5
<i>B</i>	92.2
<i>C</i>	130.1
<i>D</i>	120.4

Which specimen is the most unusually large (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 163.5 millimeters and a standard deviation of 3.7 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 160.5 and 163.7 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 242.4 grams and a standard deviation of 35 grams. A researcher plans to measure the weights of 49 of these ducks sampled randomly. What is the probability the **sample mean** will be between 233.4 and 252.9 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus fuscescens*. She randomly samples 13 adults of *Catharus fuscescens*, resulting in a sample mean of 42.23 grams and a sample standard deviation of 4.33 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 300 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 165 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
87	3.5	
20	6.8	
28	7.6	
46	5.9	
91	3.4	
32	6.7	
14	7.2	
98	3.3	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

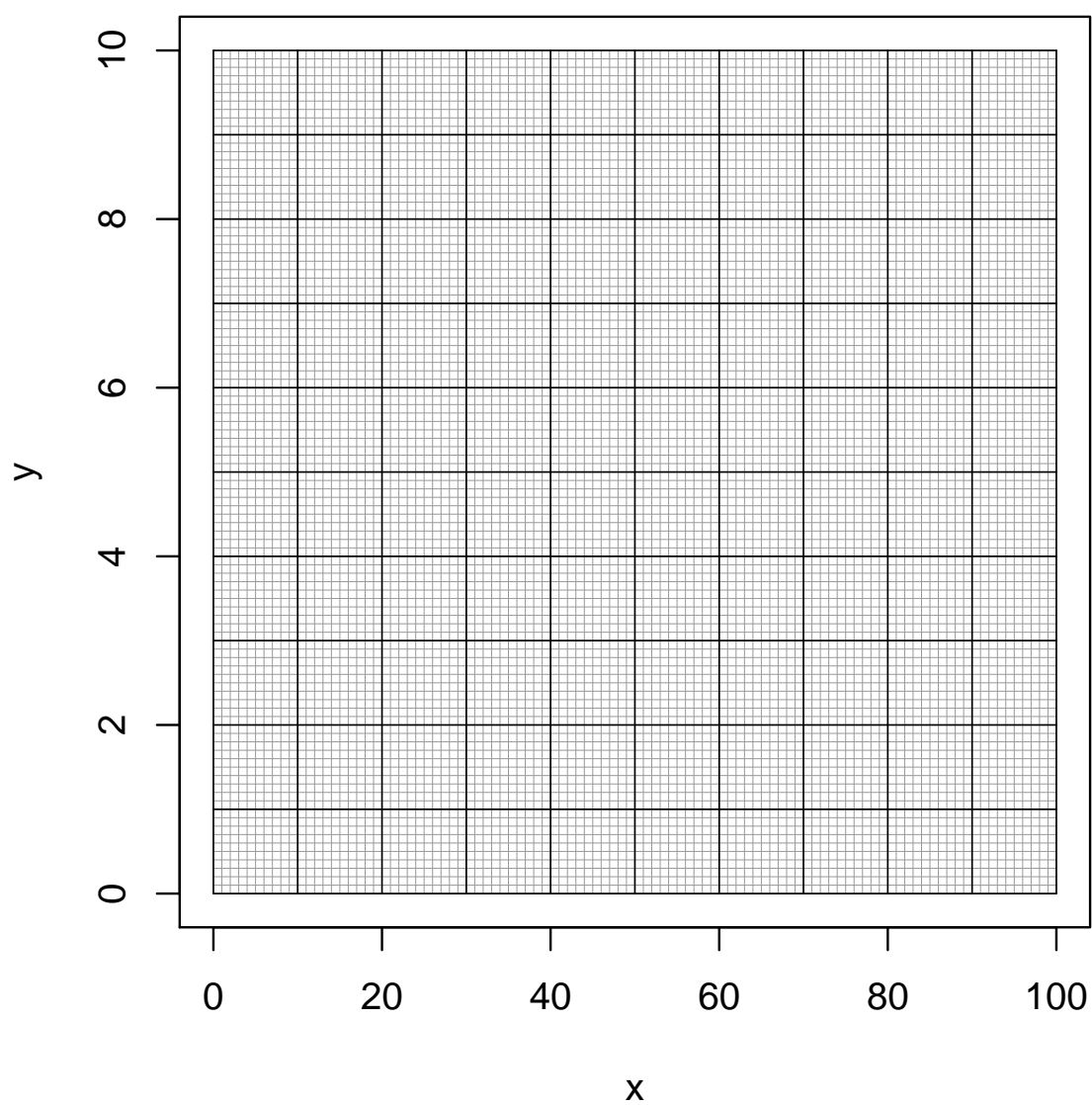
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.65$. If 70 trials occur, what is the probability of getting more than 40 but less than 46 successes?

In other words, let $X \sim \text{Bin}(n = 70, p = 0.65)$ and find $P(40 < X < 46)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 130$. You decide to run two-tail test on a sample of size $n = 8$ using a significance level $\alpha = 0.1$.

You then collect the sample:

135.3	182	215.1	118.5	146.6
166.9	211.2	96.4		

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

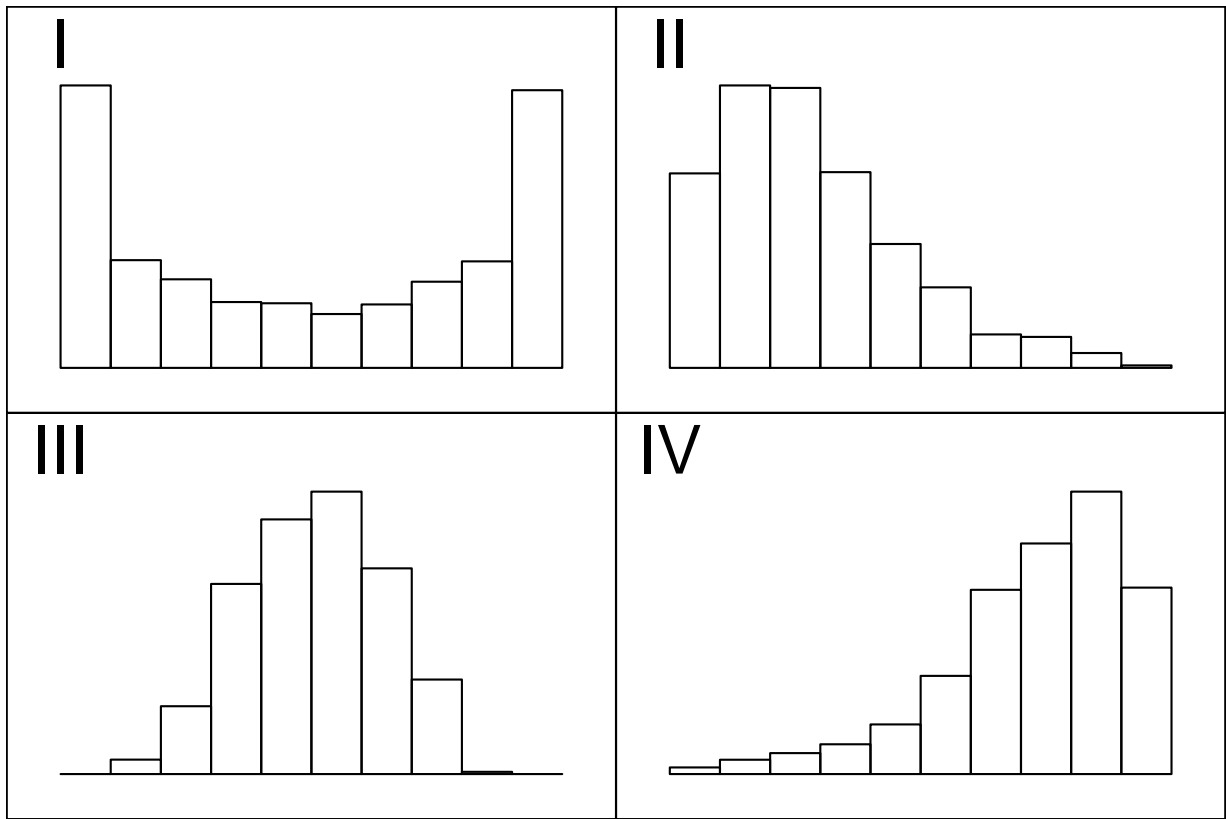
FINAL VERSION 008

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of heights of adult men
- (b) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (c) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (d) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.

2. (15 Points)

In a deck of strange cards, there are 309 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	red	teal	violet	Total
dog	22	38	37	21	118
jigsaw	29	45	15	14	103
quilt	28	24	25	11	88
Total	79	107	77	46	309

- (a) What is the probability a random card is both a jigsaw and violet?
- (b) What is the probability a random card is a quilt given it is teal?
- (c) Is a dog or a jigsaw more likely to be red?
- (d) What is the probability a random card is gray given it is a jigsaw?
- (e) What is the probability a random card is a quilt?
- (f) What is the probability a random card is either a quilt or teal (or both)?
- (g) What is the probability a random card is violet?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	123	14
<i>B</i>	138	8
<i>C</i>	103	10
<i>D</i>	146	6

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	101.3
<i>B</i>	136.1
<i>C</i>	106
<i>D</i>	136.3

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 129 millimeters and a standard deviation of 6.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 114.4 and 125.8 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 164.3 grams and a standard deviation of 130 grams. A researcher plans to measure the weights of 169 of these ducks sampled randomly. What is the probability the **sample mean** will be between 141.3 and 180.8 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Denrdoica magnolia*. She randomly samples 16 adults of *Denrdoica magnolia*, resulting in a sample mean of 9.33 grams and a sample standard deviation of 1.67 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 700 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 159 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
640	25	
900	52	
550	42	
600	35	
610	53	
400	44	
280	28	
570	19	
120	25	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

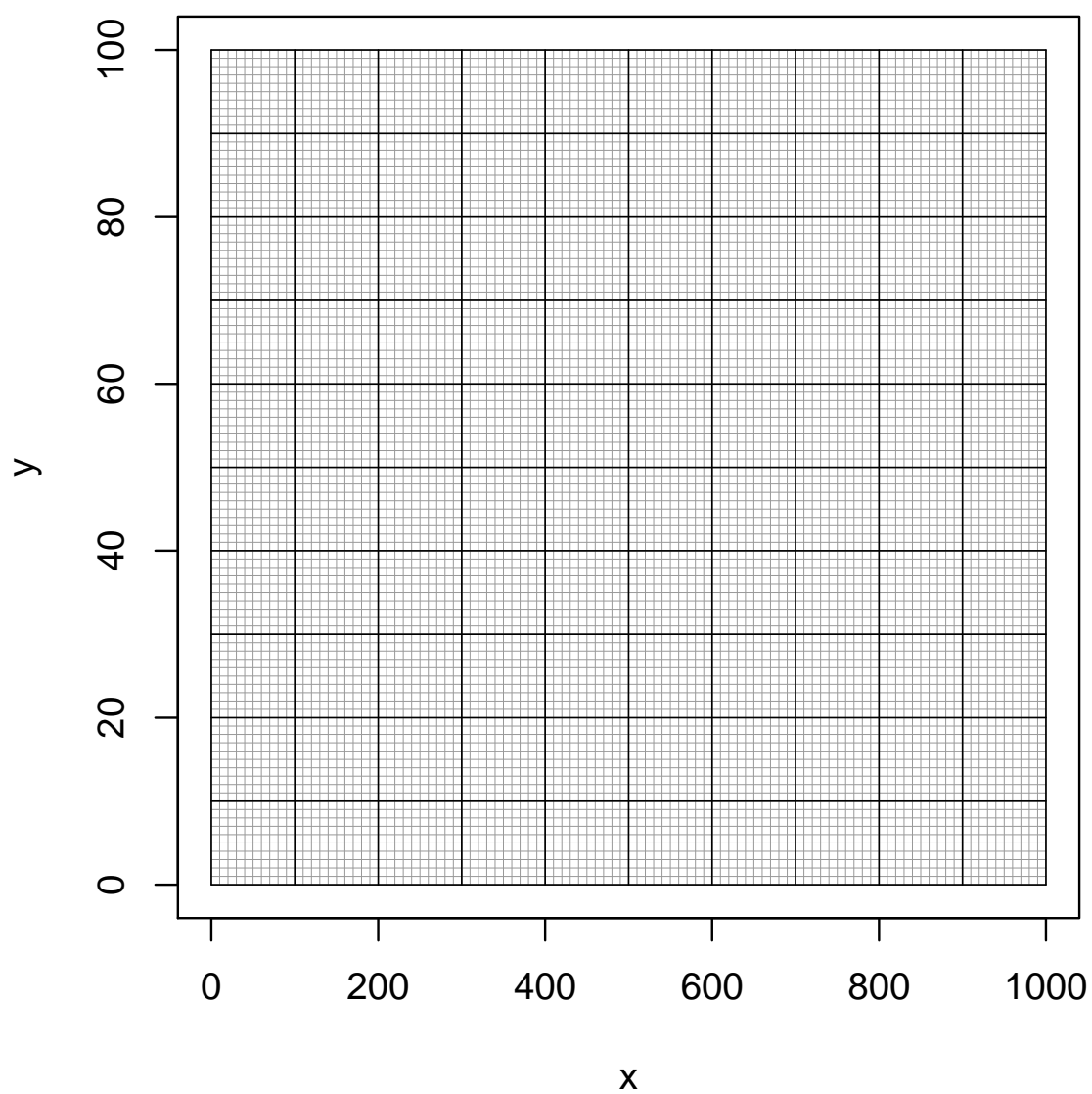
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.49$. If 129 trials occur, what is the probability of getting at least 51 but at most 77 successes?

In other words, let $X \sim \text{Bin}(n = 129, p = 0.49)$ and find $P(51 \leq X \leq 77)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 160$. You decide to run two-tail test on a sample of size $n = 8$ using a significance level $\alpha = 0.1$.

You then collect the sample:

176	169.1	160.3	162.8	165.3
151.6	166.2	169.1		

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

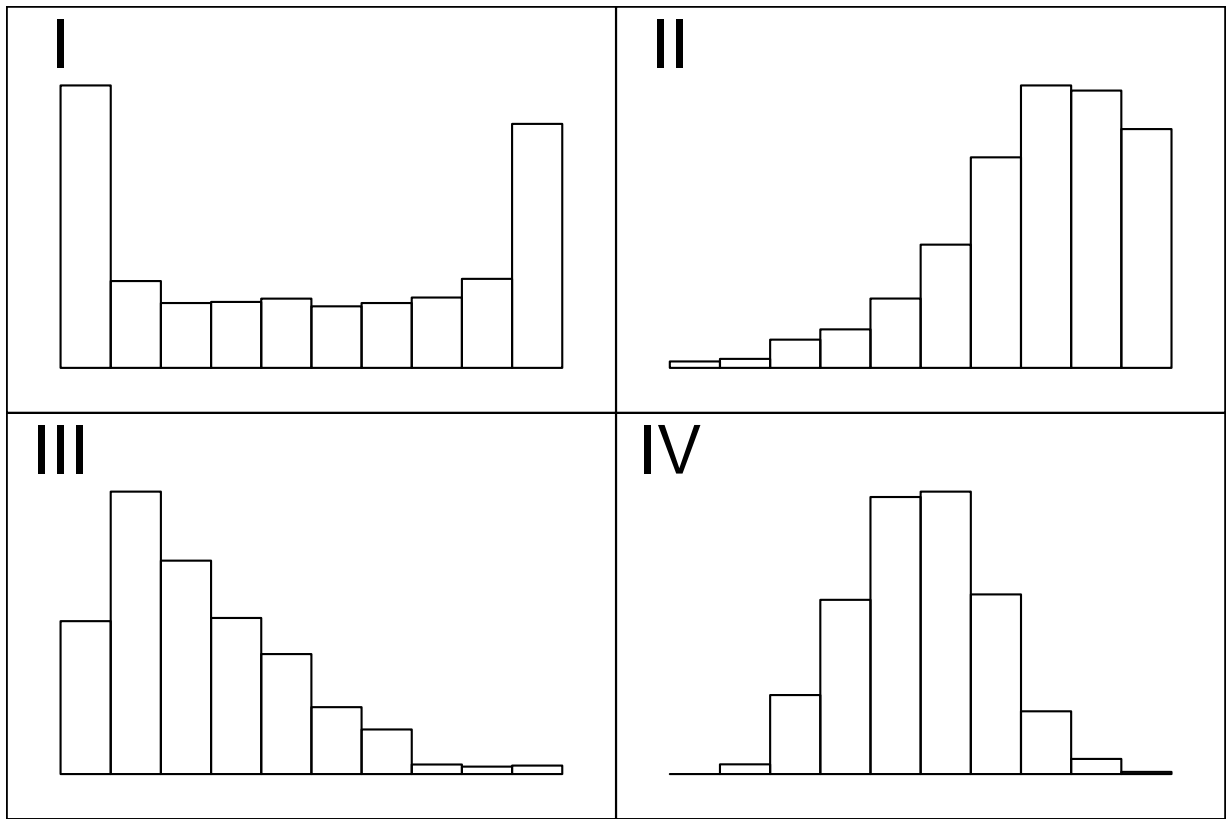
FINAL VERSION 009

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (b) The distribution of heights of adult men
- (c) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (d) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.

2. (15 Points)

In a deck of strange cards, there are 263 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	indigo	red	violet	Total
horn	11	25	19	17	72
kite	35	12	46	18	111
lamp	13	31	14	22	80
Total	59	68	79	57	263

(a) What is the probability a random card is either a kite or red (or both)?

(b) What is the probability a random card is a kite given it is red?

(c) What is the probability a random card is both a kite and violet?

(d) What is the probability a random card is violet?

(e) Is a horn or a kite more likely to be indigo?

(f) What is the probability a random card is violet given it is a horn?

(g) What is the probability a random card is a kite?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	130	6
<i>B</i>	128	7
<i>C</i>	121	8
<i>D</i>	61	13

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	122.4
<i>B</i>	123.5
<i>C</i>	113.5
<i>D</i>	74

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 114.2 millimeters and a standard deviation of 9.3 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 103.2 and 107.1 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 283.5 grams and a standard deviation of 17.5 grams. A researcher plans to measure the weights of 49 of these ducks sampled randomly. What is the probability the **sample mean** will be between 279 and 284 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Dendroica pensylvanica*. She randomly samples 19 adults of *Dendroica pensylvanica*, resulting in a sample mean of 12.34 grams and a sample standard deviation of 1.3 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 400 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 93 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
61	81	
45	28	
89	99	
72	40	
54	46	
69	65	
24	64	
18	38	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

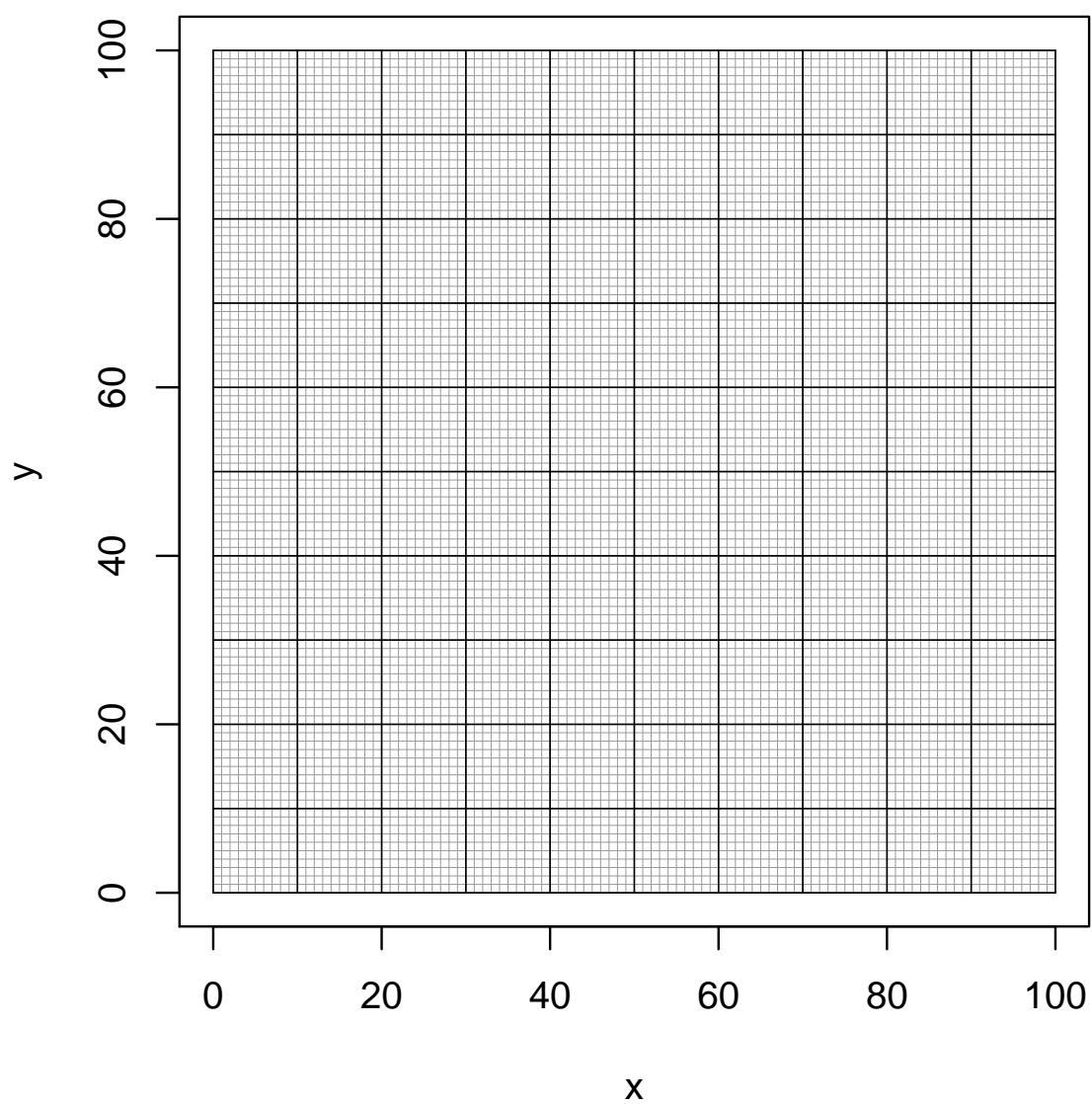
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.24$. If 113 trials occur, what is the probability of getting more than 21 but at most 34 successes?

In other words, let $X \sim \text{Bin}(n = 113, p = 0.24)$ and find $P(21 < X \leq 34)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 120$. You decide to run two-tail test on a sample of size $n = 12$ using a significance level $\alpha = 0.02$.

You then collect the sample:

121.8	122.7	141.3	130.4	129.5
110.5	122.7	115.6	138	130.6
128.3	129.3			

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

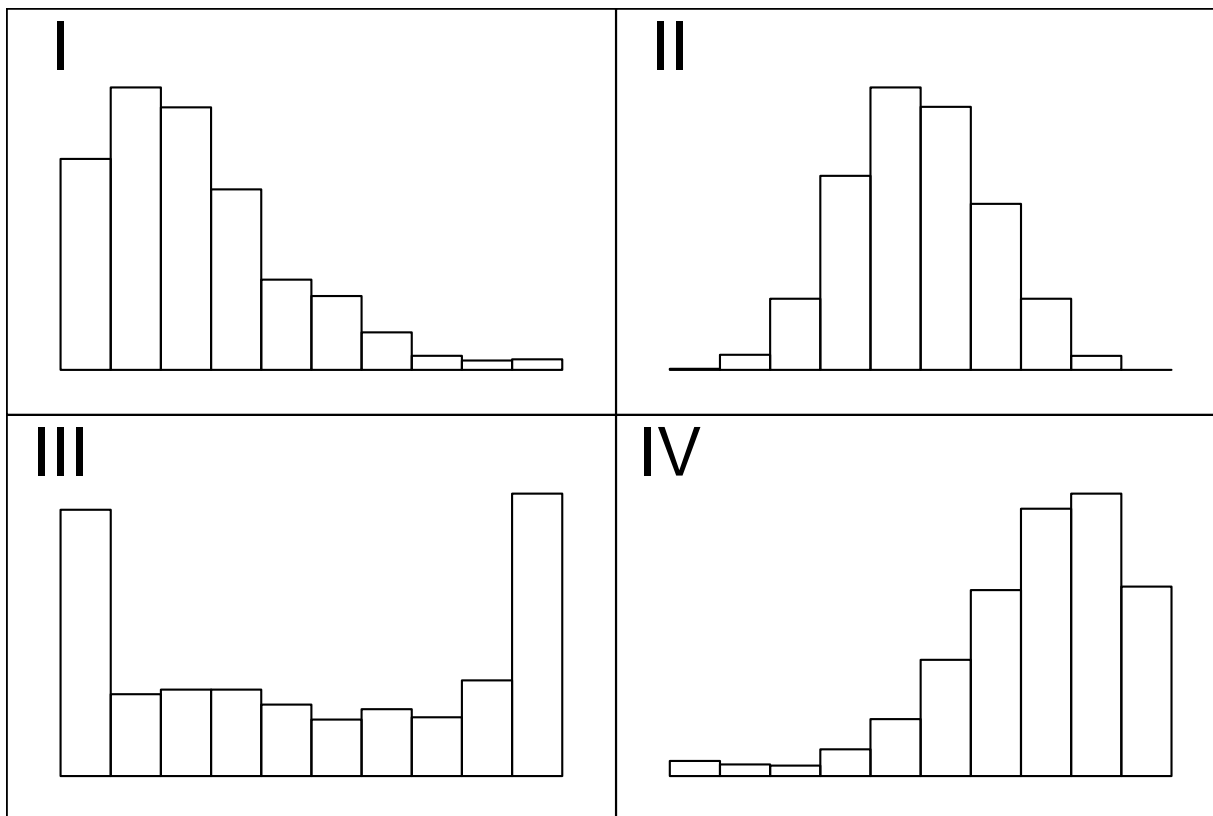
FINAL VERSION 010

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (b) The distribution of lengths of newborn babies
- (c) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (d) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.

2. (15 Points)

In a deck of strange cards, there are 514 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	orange	pink	violet	yellow	Total
bike	10	49	25	29	11	124
gem	45	28	18	34	16	141
lamp	23	33	17	13	12	98
pig	14	46	26	24	41	151
Total	92	156	86	100	80	514

- (a) What is the probability a random card is a pig given it is blue?
- (b) What is the probability a random card is a lamp?
- (c) What is the probability a random card is orange?
- (d) What is the probability a random card is blue given it is a gem?
- (e) What is the probability a random card is either a bike or blue (or both)?
- (f) What is the probability a random card is both a gem and orange?
- (g) Is a bike or a gem more likely to be blue?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	101	8
<i>B</i>	111	11
<i>C</i>	123	12
<i>D</i>	69	14

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	89.08
<i>B</i>	112.1
<i>C</i>	106.4
<i>D</i>	60.88

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 141.4 millimeters and a standard deviation of 2.7 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 144 and 147.2 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 111.5 grams and a standard deviation of 67.5 grams. A researcher plans to measure the weights of 81 of these ducks sampled randomly. What is the probability the **sample mean** will be between 96.5 and 128 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Hylocichla mustelina*. She randomly samples 20 adults of *Hylocichla mustelina*, resulting in a sample mean of 57.29 grams and a sample standard deviation of 7.67 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 200 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 110 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
58	760	
54	620	
93	470	
41	650	
90	480	
41	570	
34	740	
64	680	
25	800	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

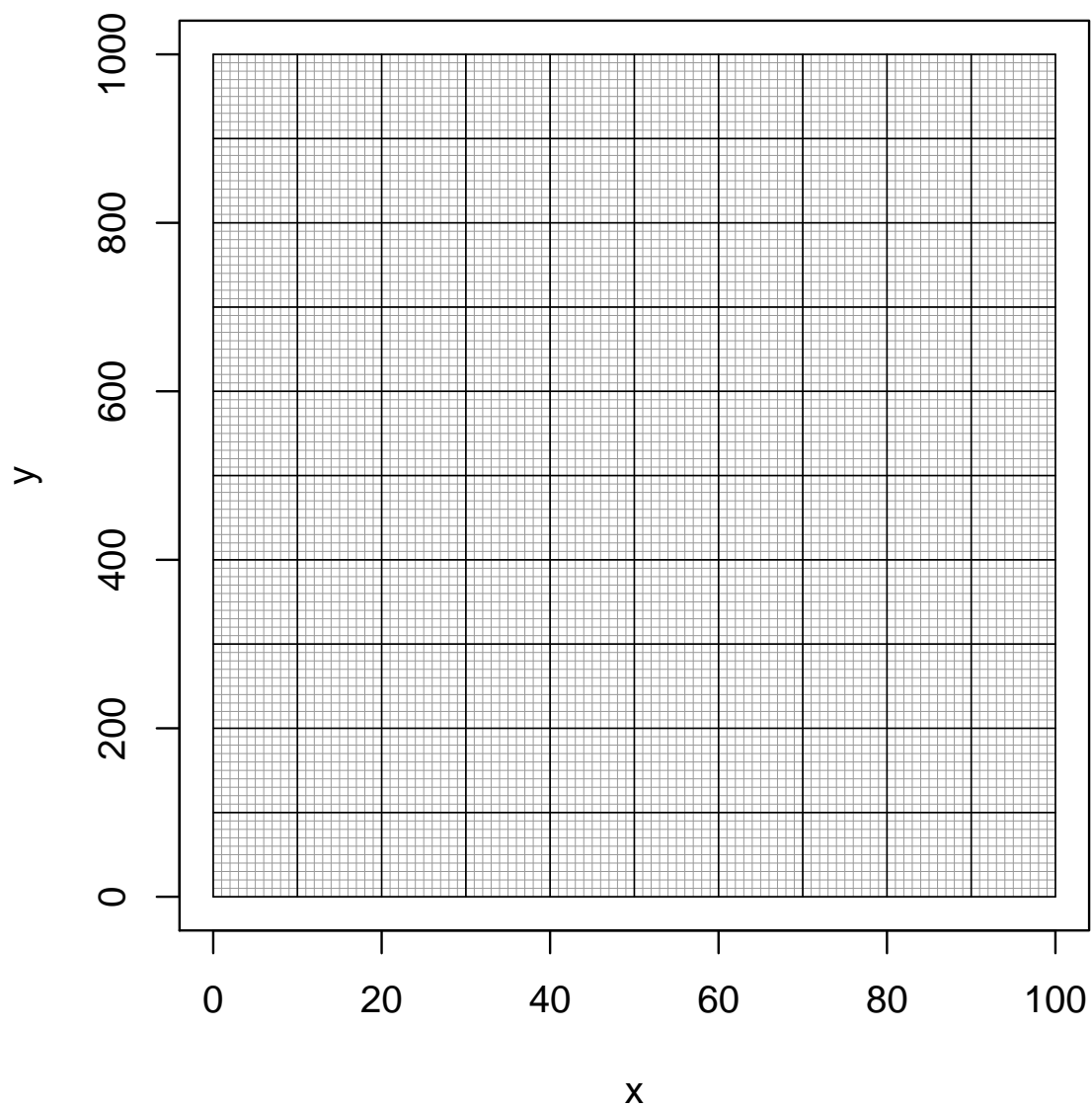
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.46$. If 174 trials occur, what is the probability of getting more than 64 but less than 87 successes?

In other words, let $X \sim \text{Bin}(n = 174, p = 0.46)$ and find $P(64 < X < 87)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 60$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.01$.

You then collect the sample:

57.1	74.5	65	61.3	69.1
76.7	62.8	70.2	78.7	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

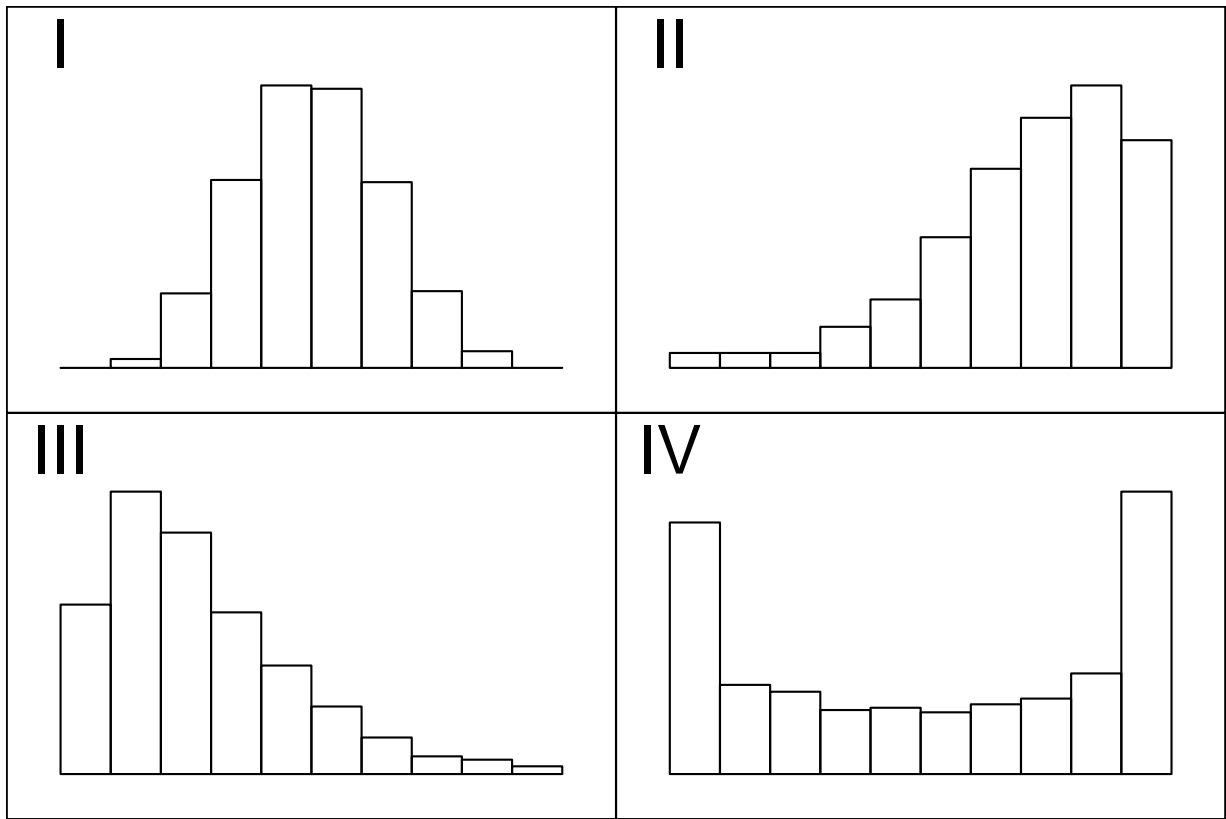
FINAL VERSION 011

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (d) The distribution of heights of adult women

2. (15 Points)

In a deck of strange cards, there are 737 cards. Each card has an image and a color. The amounts are shown in the table below.

	orange	red	teal	violet	white	Total
bike	24	36	14	38	37	149
cat	35	15	49	31	30	160
gem	45	34	13	26	40	158
lamp	20	46	48	27	21	162
pig	10	33	18	22	25	108
Total	134	164	142	144	153	737

- (a) Is a cat or a pig more likely to be violet?
- (b) What is the probability a random card is either a gem or orange (or both)?
- (c) What is the probability a random card is violet given it is a cat?
- (d) What is the probability a random card is white?
- (e) What is the probability a random card is a pig?
- (f) What is the probability a random card is a bike given it is orange?
- (g) What is the probability a random card is both a gem and white?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	113	4
<i>B</i>	73	5
<i>C</i>	101	14
<i>D</i>	93	12

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	115.2
<i>B</i>	68.25
<i>C</i>	120
<i>D</i>	110.4

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 59.4 millimeters and a standard deviation of 10 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 50.1 and 57.9 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 265.6 grams and a standard deviation of 20 grams. A researcher plans to measure the weights of 64 of these ducks sampled randomly. What is the probability the **sample mean** will be between 263.6 and 265.6 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Cistothorus palustris*. She randomly samples 31 adults of *Cistothorus palustris*, resulting in a sample mean of 9.87 grams and a sample standard deviation of 1.22 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 600 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 169 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
260	77	
720	41	
300	67	
600	49	
610	28	
660	36	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

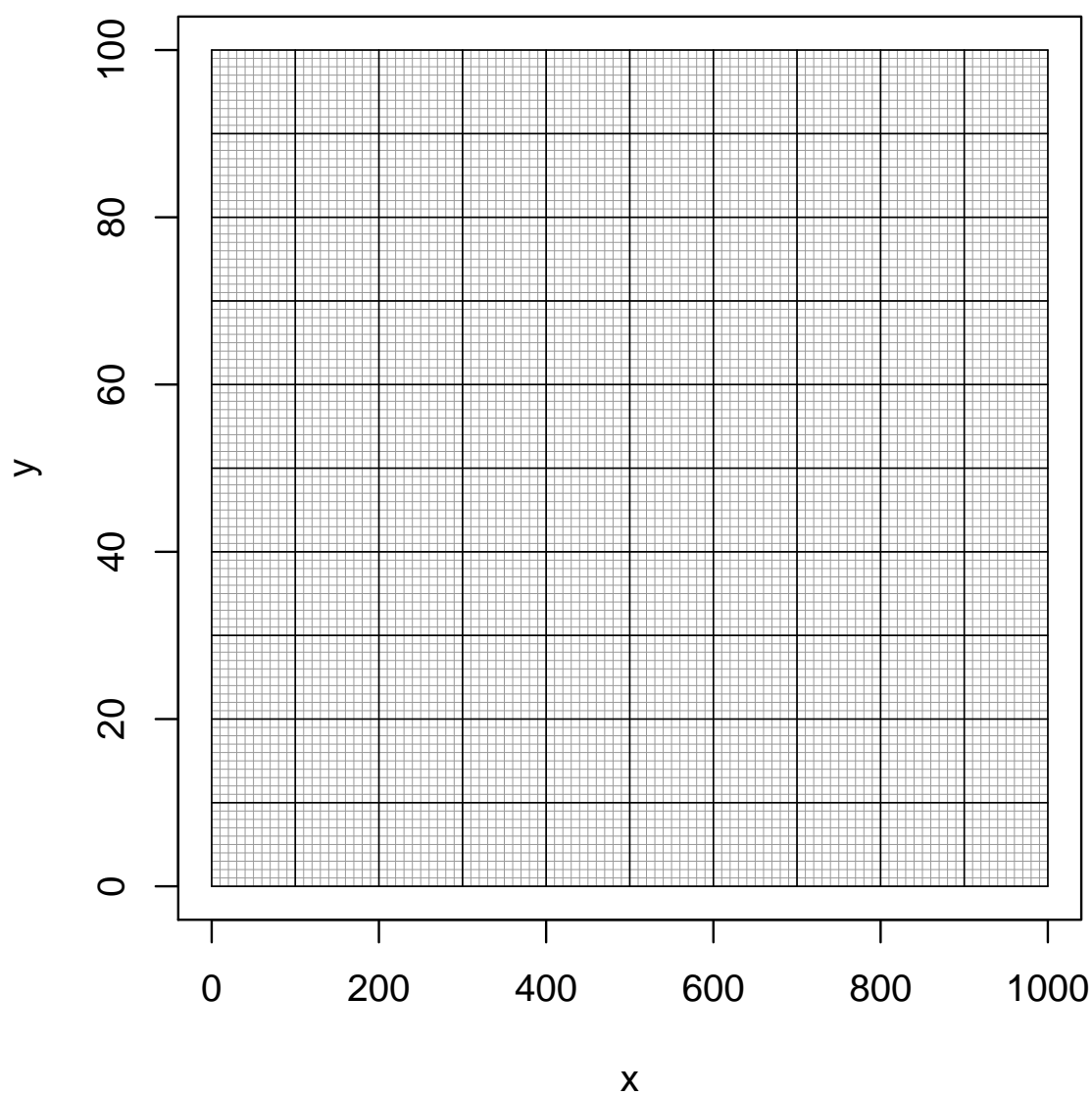
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.58$. If 72 trials occur, what is the probability of getting at least 33 but less than 44 successes?

In other words, let $X \sim \text{Bin}(n = 72, p = 0.58)$ and find $P(33 \leq X < 44)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 170$. You decide to run two-tail test on a sample of size $n = 8$ using a significance level $\alpha = 0.05$.

You then collect the sample:

201.3	156.7	187.4	169.1	211.5
215.3	214.1	166.1		

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

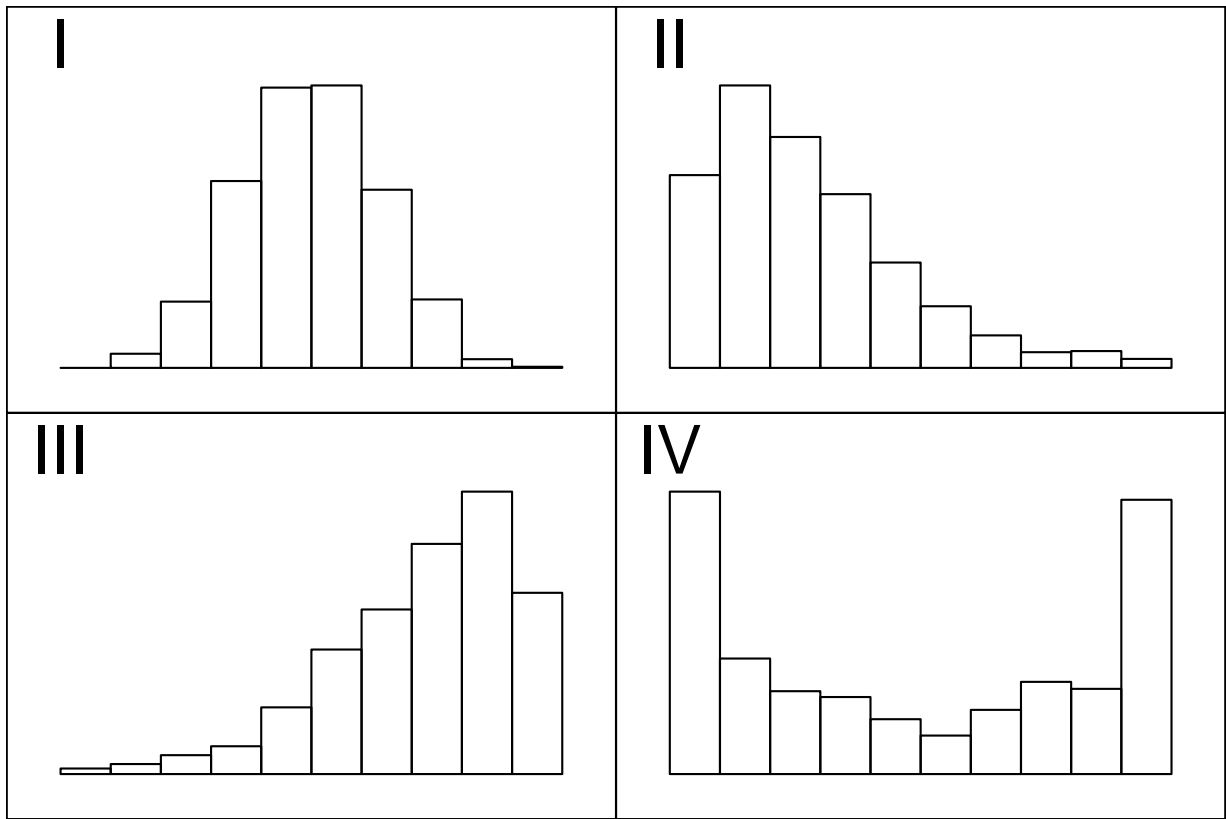
FINAL VERSION 012

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (b) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (c) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (d) The distribution of lengths of newborn babies

2. (15 Points)

In a deck of strange cards, there are 582 cards. Each card has an image and a color. The amounts are shown in the table below.

	green	pink	red	teal	violet	Total
dog	27	28	46	26	14	141
flower	23	49	39	36	18	165
horn	41	19	24	12	16	112
quilt	10	13	50	44	47	164
Total	101	109	159	118	95	582

- (a) What is the probability a random card is a quilt?
- (b) What is the probability a random card is green given it is a flower?
- (c) What is the probability a random card is either a horn or green (or both)?
- (d) Is a dog or a horn more likely to be violet?
- (e) What is the probability a random card is a dog given it is teal?
- (f) What is the probability a random card is violet?
- (g) What is the probability a random card is both a flower and violet?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	145	10
<i>B</i>	117	8
<i>C</i>	106	14
<i>D</i>	122	6

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	126.8
<i>B</i>	118.9
<i>C</i>	97.74
<i>D</i>	122.6

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 144 millimeters and a standard deviation of 8.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 136 and 159.9 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 278.5 grams and a standard deviation of 24 grams. A researcher plans to measure the weights of 144 of these ducks sampled randomly. What is the probability the **sample mean** will be between 276.5 and 279 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Piranga olivacea*. She randomly samples 21 adults of *Piranga olivacea*, resulting in a sample mean of 38.75 grams and a sample standard deviation of 4.05 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 900 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 202 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
58	4.2	
16	1.3	
41	1.3	
97	5.6	
60	3.7	
87	3.9	
84	3.7	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

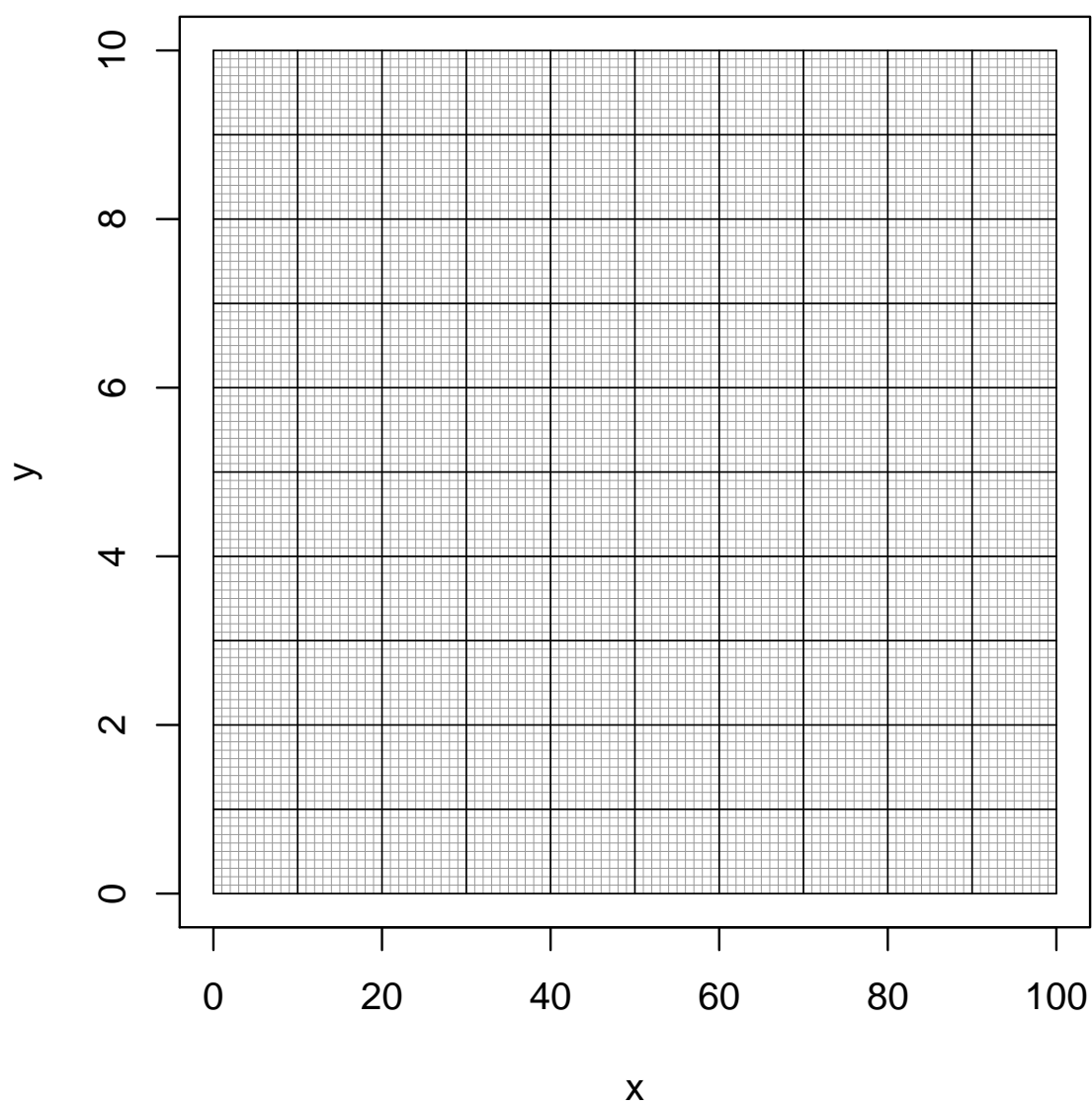
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.25$. If 147 trials occur, what is the probability of getting more than 26 but at most 37 successes?

In other words, let $X \sim \text{Bin}(n = 147, p = 0.25)$ and find $P(26 < X \leq 37)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 170$. You decide to run two-tail test on a sample of size $n = 10$ using a significance level $\alpha = 0.1$.

You then collect the sample:

167.6	176.9	177.3	153.5	180.4
182.9	171.3	189.4	182.3	174.8

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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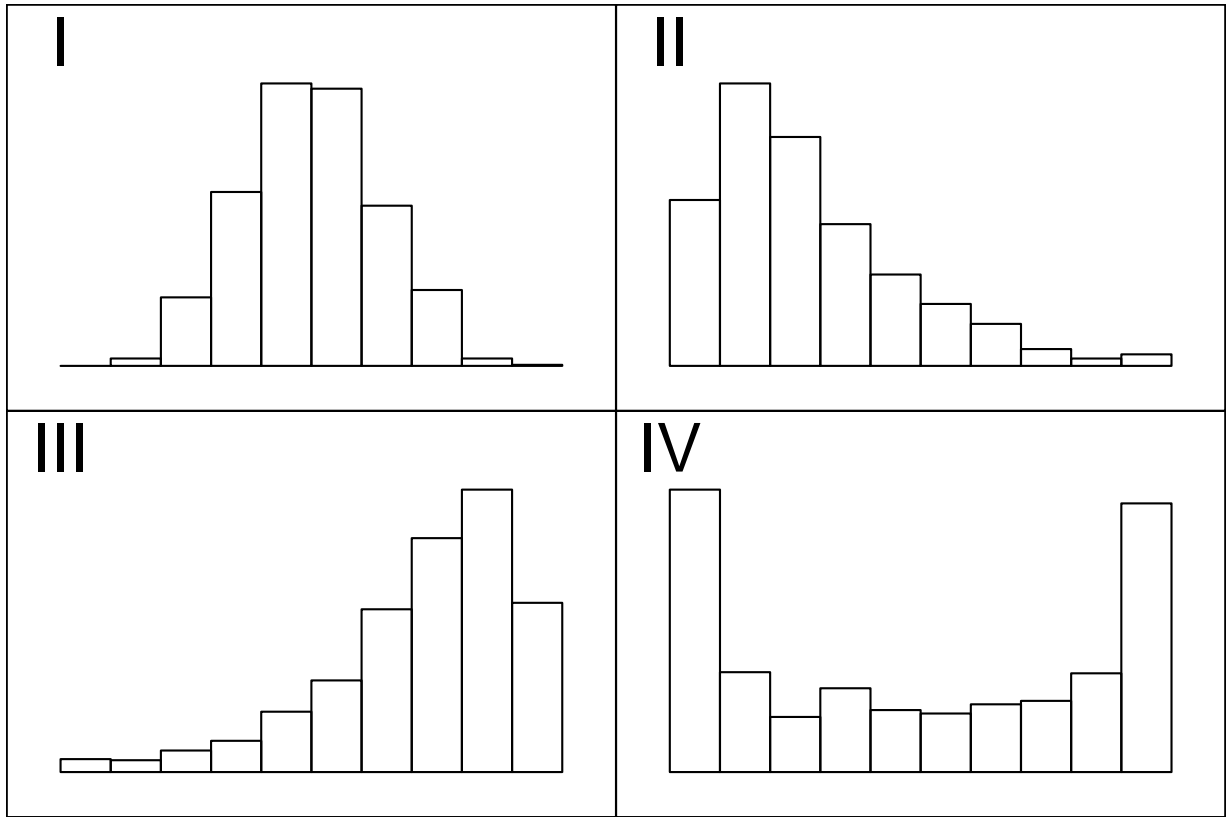
FINAL VERSION 013

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of heights of adult men
- (b) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (c) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (d) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.

2. (15 Points)

In a deck of strange cards, there are 408 cards. Each card has an image and a color. The amounts are shown in the table below.

	green	orange	teal	violet	white	Total
bike	33	20	47	30	17	147
gem	11	13	24	38	41	127
jigsaw	50	28	31	15	10	134
Total	94	61	102	83	68	408

- (a) What is the probability a random card is both a jigsaw and teal?
- (b) What is the probability a random card is violet?
- (c) What is the probability a random card is a bike given it is green?
- (d) What is the probability a random card is a gem?
- (e) What is the probability a random card is violet given it is a jigsaw?
- (f) What is the probability a random card is either a bike or green (or both)?
- (g) Is a bike or a jigsaw more likely to be green?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	90	4
<i>B</i>	147	15
<i>C</i>	72	14
<i>D</i>	93	6

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	90.2
<i>B</i>	136
<i>C</i>	61.22
<i>D</i>	87.36

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 127.9 millimeters and a standard deviation of 7.6 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 119.5 and 132.4 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 216 grams and a standard deviation of 14 grams. A researcher plans to measure the weights of 49 of these ducks sampled randomly. What is the probability the **sample mean** will be between 217 and 218.5 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Ammodramus maritimus*. She randomly samples 27 adults of *Ammodramus maritimus*, resulting in a sample mean of 21.67 grams and a sample standard deviation of 1.56 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 800 questions. Each question has 3 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 292 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
7.6	30	
2	60	
3.3	66	
5.8	50	
5.2	56	
7.1	45	
3.6	61	
8.8	30	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

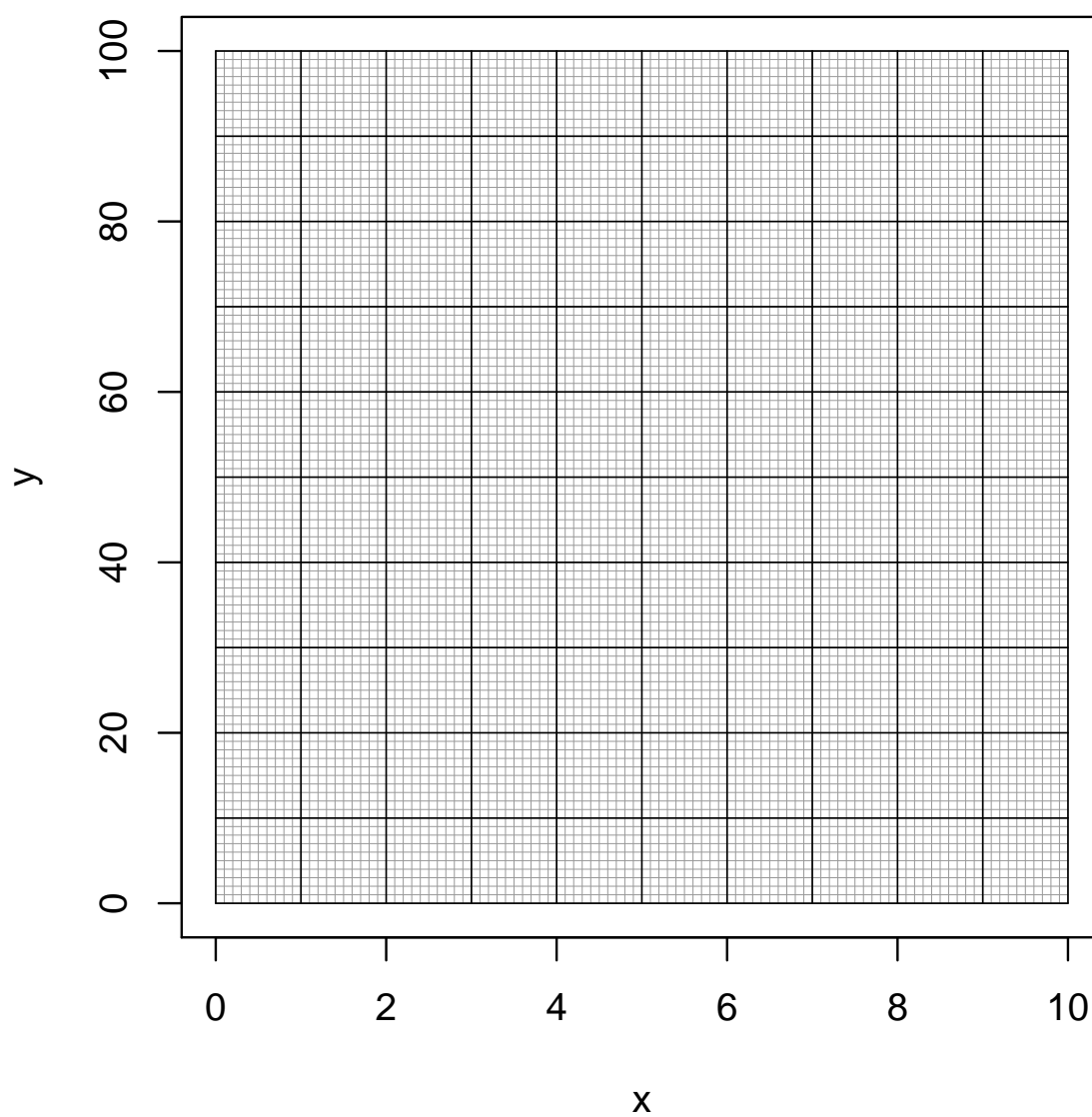
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.1$. If 186 trials occur, what is the probability of getting at least 16 but less than 28 successes?

In other words, let $X \sim \text{Bin}(n = 186, p = 0.1)$ and find $P(16 \leq X < 28)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 100$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.1$.

You then collect the sample:

125.7	66.5	70.5	86.2	123.4
143.1	107.7	150.4	129.7	132.2
163.8				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

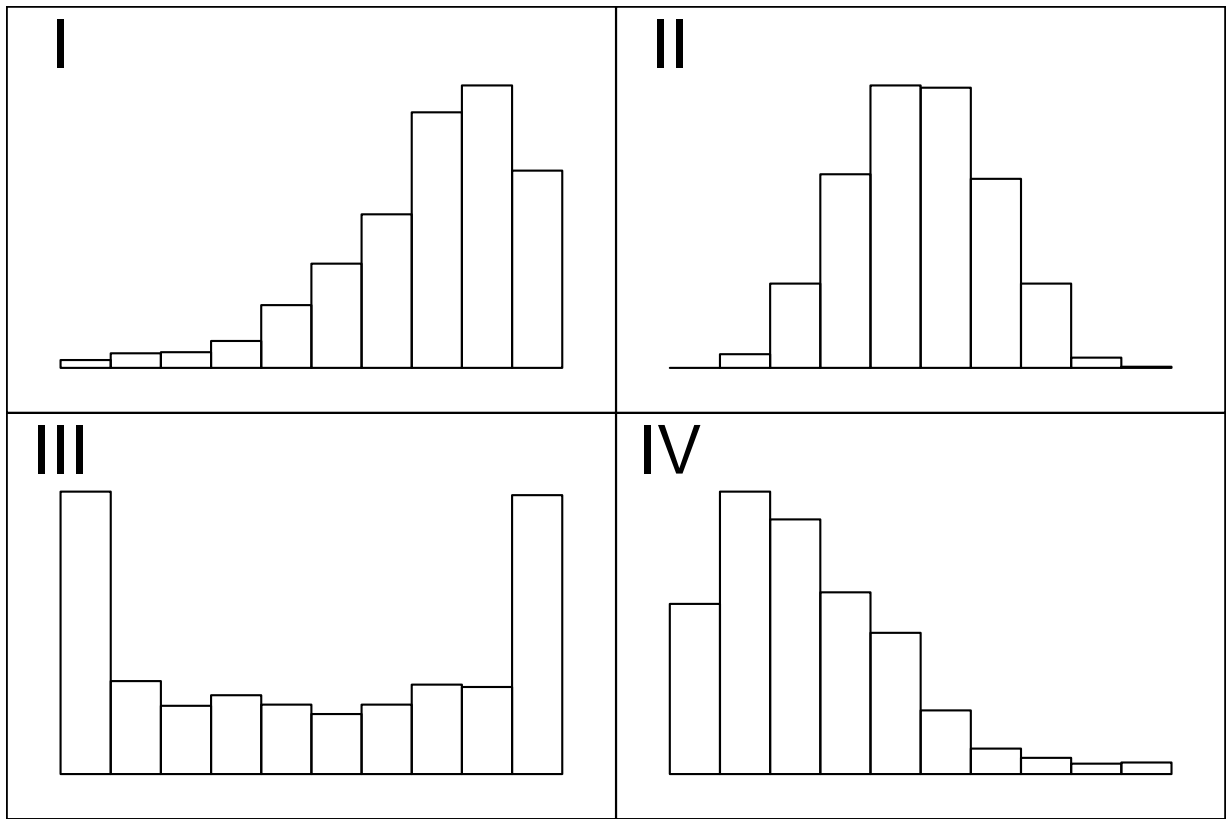
FINAL VERSION 014

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (b) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (c) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (d) The distribution of heights of adult men

2. (15 Points)

In a deck of strange cards, there are 490 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	gray	violet	white	yellow	Total
bike	34	27	31	46	32	170
cat	18	37	25	45	36	161
flower	50	20	49	16	24	159
Total	102	84	105	107	92	490

- (a) What is the probability a random card is a bike?
- (b) What is the probability a random card is both a bike and white?
- (c) What is the probability a random card is either a flower or black (or both)?
- (d) What is the probability a random card is white?
- (e) What is the probability a random card is a cat given it is gray?
- (f) What is the probability a random card is yellow given it is a cat?
- (g) Is a bike or a cat more likely to be gray?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	68	4
<i>B</i>	90	15
<i>C</i>	76	9
<i>D</i>	132	11

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	68.72
<i>B</i>	72
<i>C</i>	81.58
<i>D</i>	129.4

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 100.3 millimeters and a standard deviation of 3.1 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 95.9 and 101.7 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 122 grams and a standard deviation of 80 grams. A researcher plans to measure the weights of 100 of these ducks sampled randomly. What is the probability the **sample mean** will be between 116 and 134 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Vireo griseus*. She randomly samples 15 adults of *Vireo griseus*, resulting in a sample mean of 10.09 grams and a sample standard deviation of 0.767 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 800 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 426 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
16	4.7	
73	6.8	
51	2.1	
74	8.6	
19	3.8	
29	1.4	
74	5.1	
58	2.2	
30	3.2	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

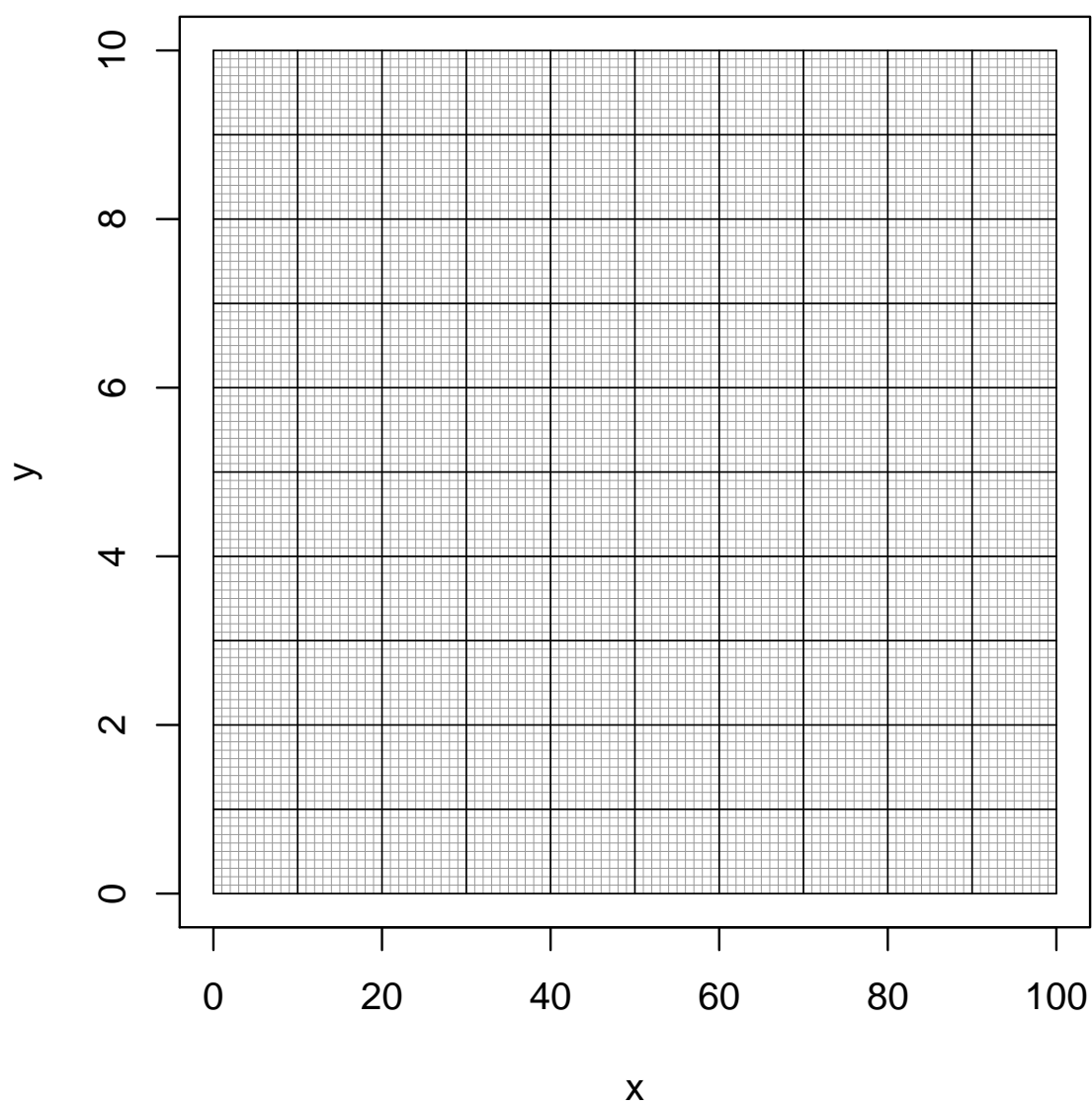
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.56$. If 80 trials occur, what is the probability of getting at least 49 but less than 56 successes?

In other words, let $X \sim \text{Bin}(n = 80, p = 0.56)$ and find $P(49 \leq X < 56)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 180$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.02$.

You then collect the sample:

279.6	201.7	237.5	158.6	190
248.6	190.7	211	218.7	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

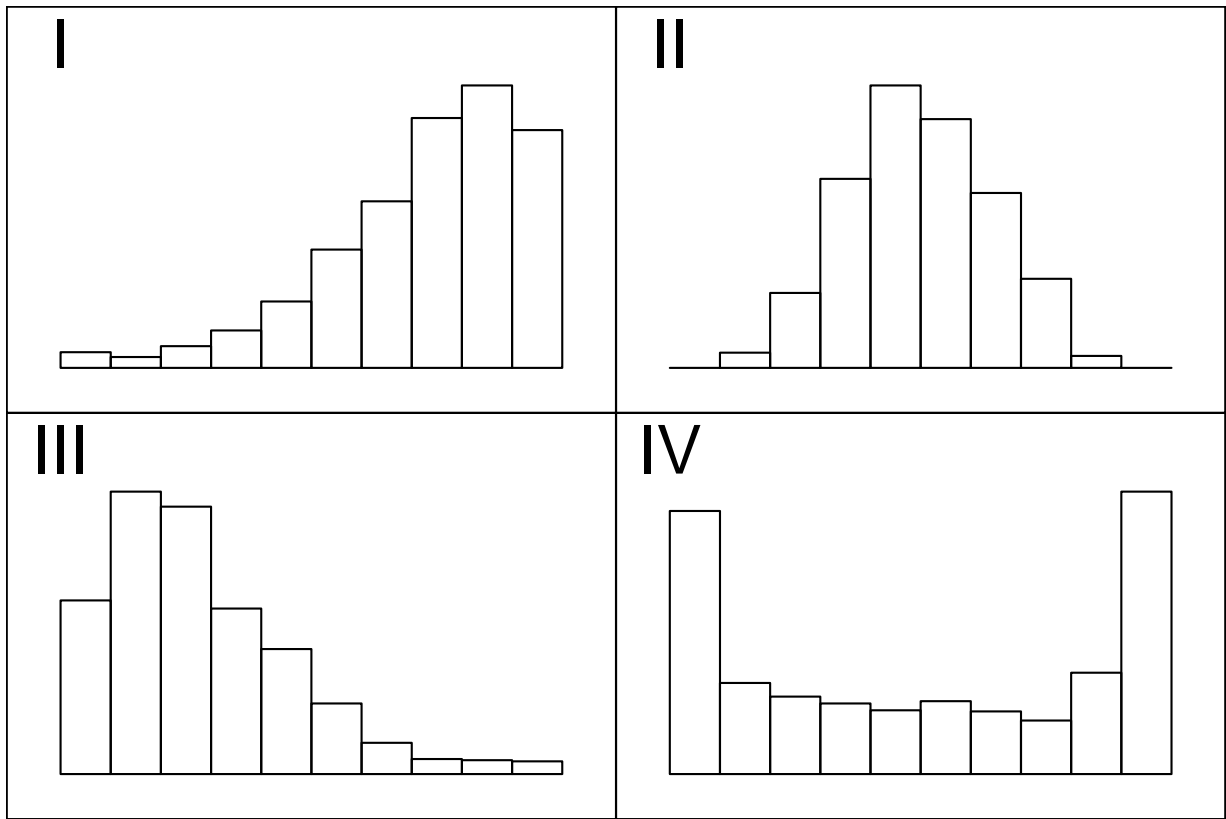
FINAL VERSION 015

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of heights of adult men
- (b) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (c) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (d) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.

2. (15 Points)

In a deck of strange cards, there are 406 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	green	red	Total
dog	35	24	15	74
horn	36	26	46	108
kite	44	42	20	106
rug	49	28	41	118
Total	164	120	122	406

- (a) Is a horn or a rug more likely to be red?
- (b) What is the probability a random card is a rug?
- (c) What is the probability a random card is both a dog and gray?
- (d) What is the probability a random card is a kite given it is gray?
- (e) What is the probability a random card is green?
- (f) What is the probability a random card is red given it is a dog?
- (g) What is the probability a random card is either a horn or red (or both)?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	70	12
<i>B</i>	125	15
<i>C</i>	69	5
<i>D</i>	92	10

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	58.12
<i>B</i>	138.4
<i>C</i>	64.35
<i>D</i>	90.2

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 35.8 millimeters and a standard deviation of 7.5 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 34.3 and 48.6 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 238.4 grams and a standard deviation of 55 grams. A researcher plans to measure the weights of 121 of these ducks sampled randomly. What is the probability the **sample mean** will be between 236.9 and 243.9 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus fuscescens*. She randomly samples 30 adults of *Catharus fuscescens*, resulting in a sample mean of 40.67 grams and a sample standard deviation of 4.76 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 700 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 159 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
26	18	
22	52	
15	30	
93	80	
44	55	
32	42	
81	63	
21	39	
13	19	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

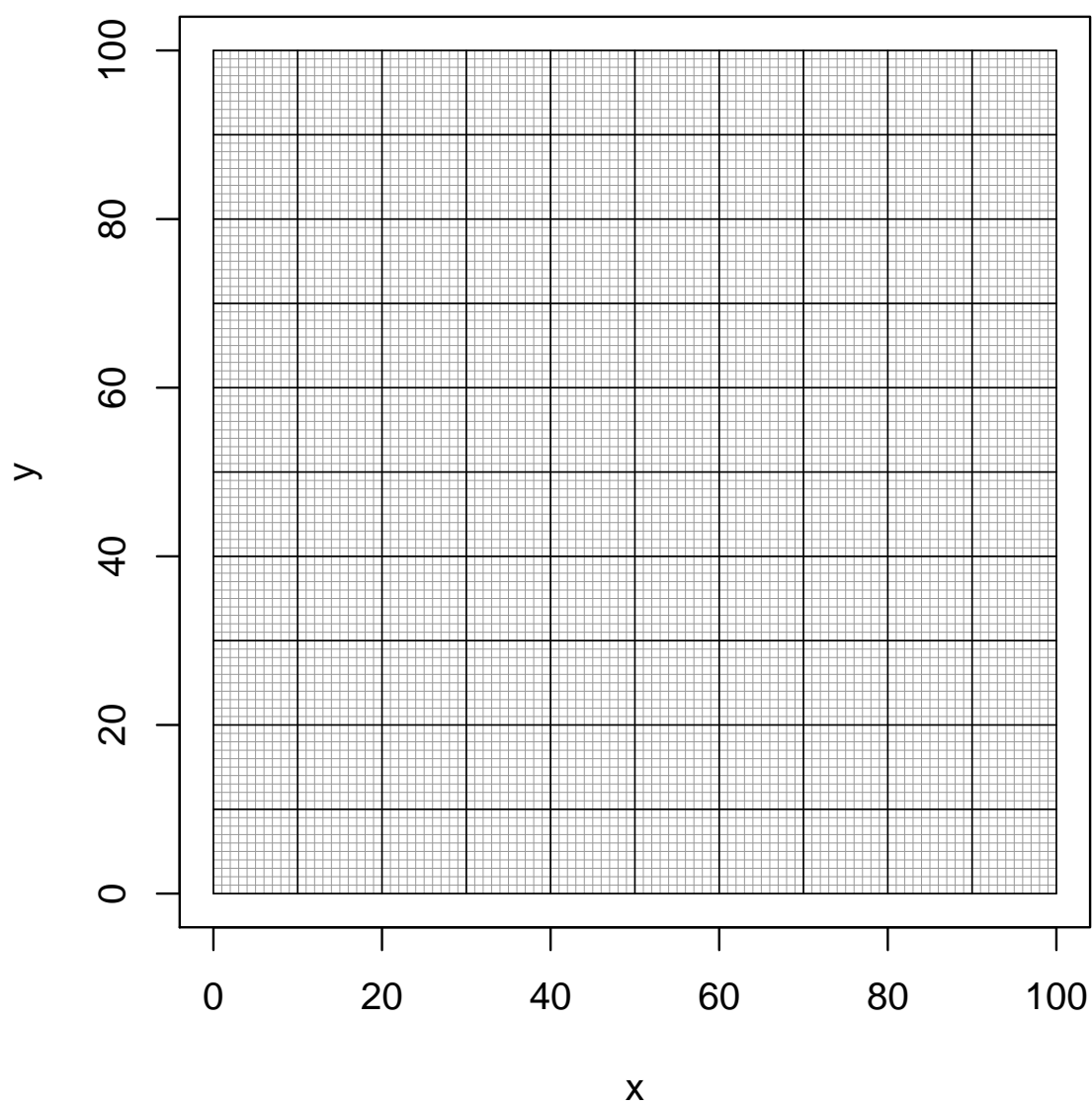
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.67$. If 168 trials occur, what is the probability of getting at least 104 but at most 128 successes?

In other words, let $X \sim \text{Bin}(n = 168, p = 0.67)$ and find $P(104 \leq X \leq 128)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 60$. You decide to run two-tail test on a sample of size $n = 12$ using a significance level $\alpha = 0.1$.

You then collect the sample:

81.3	70.6	55.6	64.9	69.8
78.3	50.3	66	69	68.5
46.1	65.1			

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

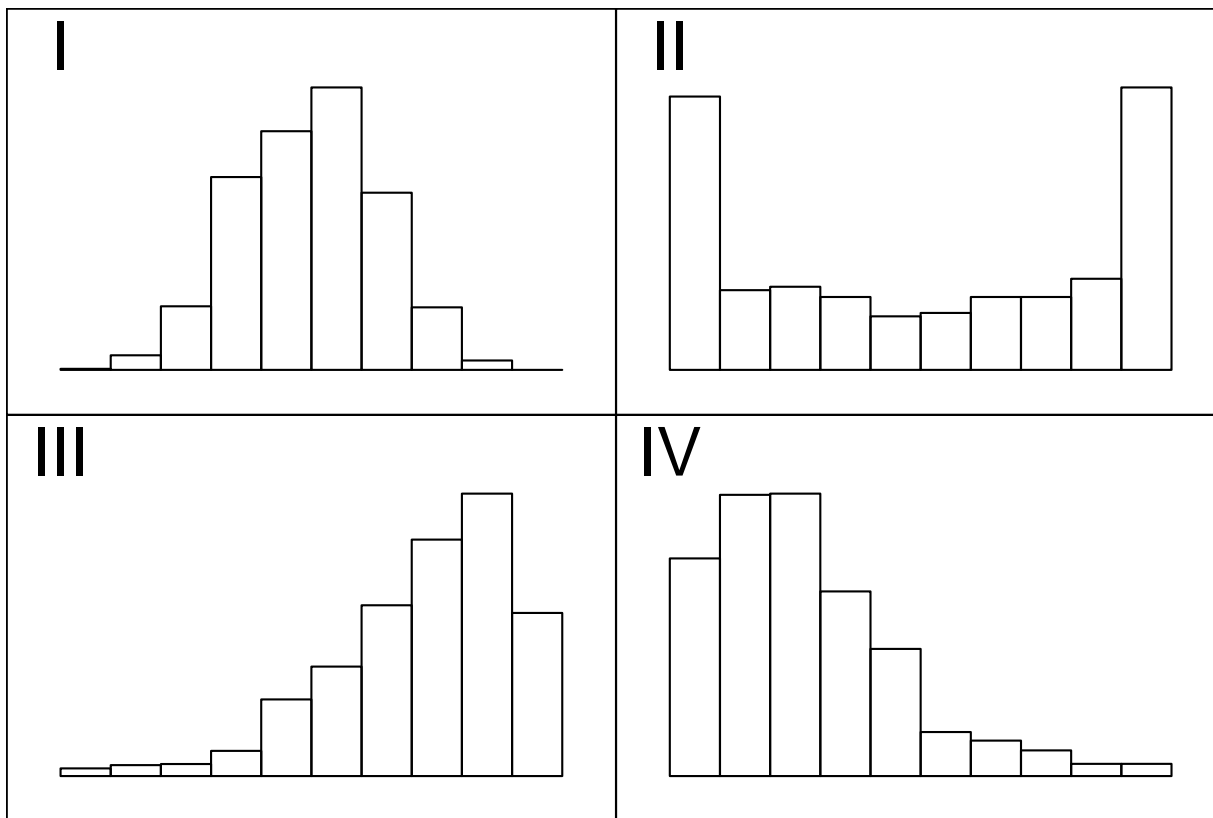
FINAL VERSION 016

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of lengths of newborn babies
- (d) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.

2. (15 Points)

In a deck of strange cards, there are 361 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	blue	pink	red	Total
cat	22	42	29	12	105
gem	37	19	49	34	139
quilt	26	45	33	13	117
Total	85	106	111	59	361

- (a) What is the probability a random card is a cat?
- (b) What is the probability a random card is both a cat and blue?
- (c) What is the probability a random card is pink given it is a gem?
- (d) What is the probability a random card is a quilt given it is red?
- (e) What is the probability a random card is either a quilt or pink (or both)?
- (f) Is a cat or a quilt more likely to be pink?
- (g) What is the probability a random card is pink?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	150	4
<i>B</i>	74	11
<i>C</i>	136	15
<i>D</i>	114	10

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	146.3
<i>B</i>	78.07
<i>C</i>	131.6
<i>D</i>	110.4

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 31.2 millimeters and a standard deviation of 7.1 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 21.3 and 28.6 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 215.7 grams and a standard deviation of 19.8 grams. A researcher plans to measure the weights of 81 of these ducks sampled randomly. What is the probability the **sample mean** will be between 210.2 and 221.2 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Seiurus aurocapillus*. She randomly samples 29 adults of *Seiurus aurocapillus*, resulting in a sample mean of 22.62 grams and a sample standard deviation of 1.44 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 800 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 221 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
24	37	
62	40	
51	18	
61	44	
75	29	
26	21	
21	15	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

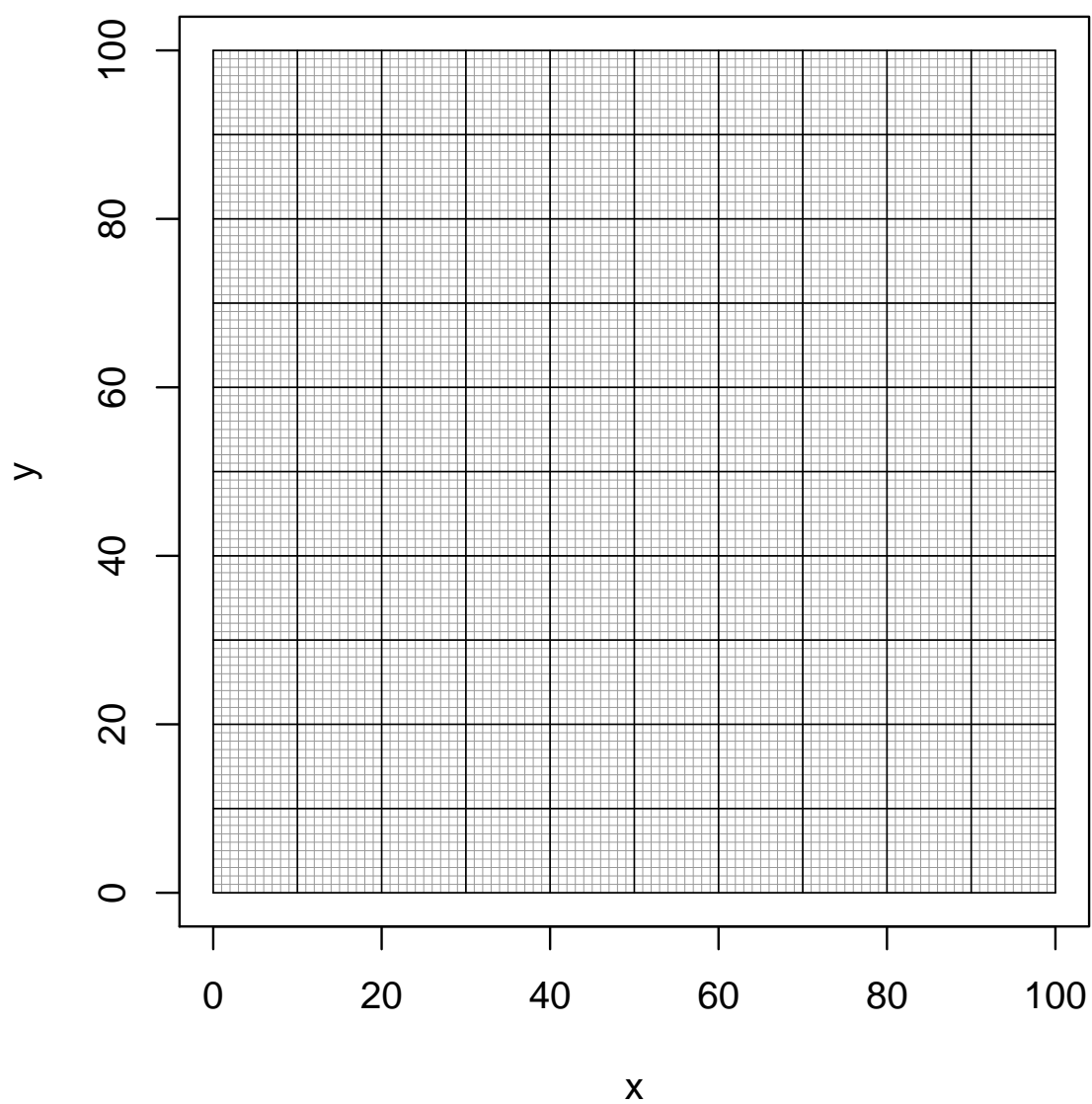
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.87$. If 118 trials occur, what is the probability of getting more than 100 but less than 107 successes?

In other words, let $X \sim \text{Bin}(n = 118, p = 0.87)$ and find $P(100 < X < 107)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 250$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.02$.

You then collect the sample:

319.8	350.5	234.2	305	229.3
269.4	292	245.2	290	259.5
322.6				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

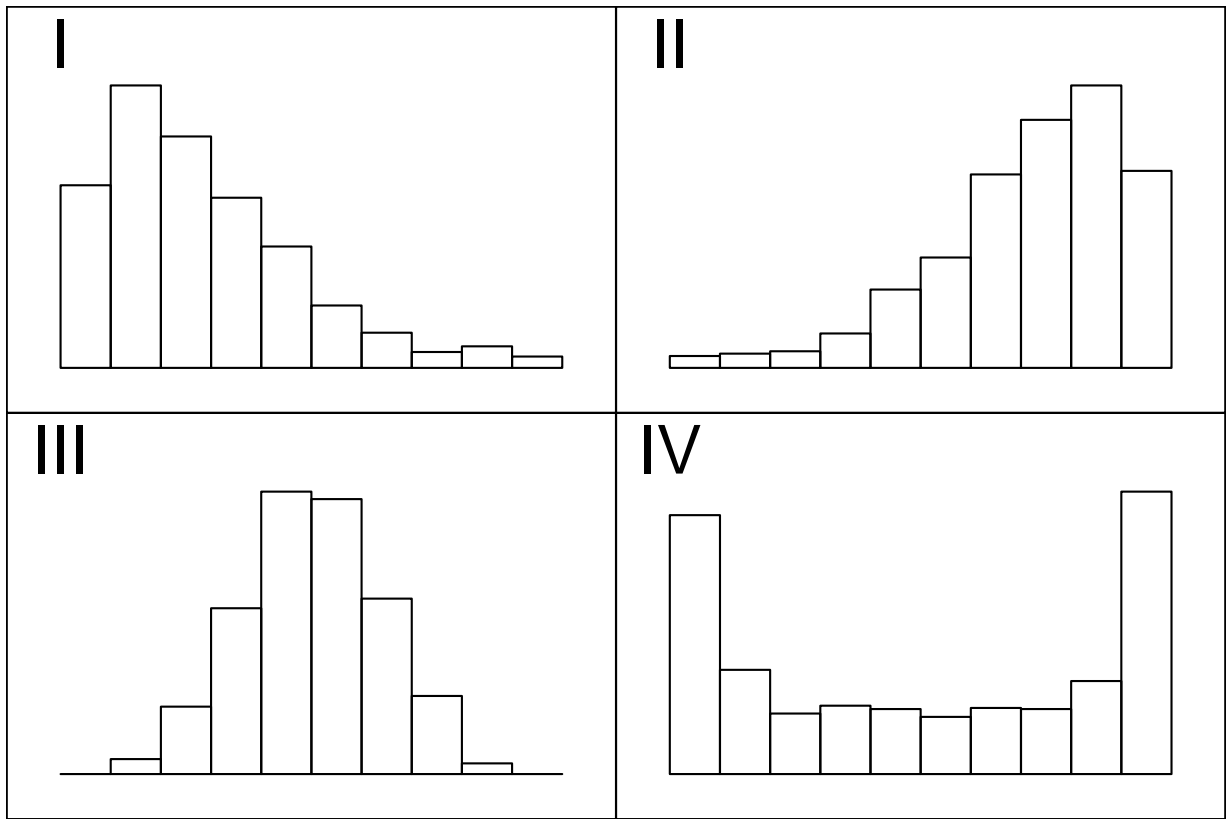
FINAL VERSION 017

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (d) The distribution of weights of newborn babies

2. (15 Points)

In a deck of strange cards, there are 486 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	orange	pink	red	Total
bike	29	22	34	21	106
cat	35	18	48	45	146
dog	19	10	30	49	108
quilt	16	40	42	28	126
Total	99	90	154	143	486

- (a) What is the probability a random card is a cat?
- (b) What is the probability a random card is a dog given it is orange?
- (c) Is a bike or a cat more likely to be red?
- (d) What is the probability a random card is either a cat or red (or both)?
- (e) What is the probability a random card is orange?
- (f) What is the probability a random card is both a cat and red?
- (g) What is the probability a random card is red given it is a bike?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	73	13
<i>B</i>	60	7
<i>C</i>	114	6
<i>D</i>	94	12

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	61.43
<i>B</i>	56.01
<i>C</i>	112.6
<i>D</i>	104.1

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 122.8 millimeters and a standard deviation of 5.7 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 125.4 and 127.2 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 215.3 grams and a standard deviation of 20 grams. A researcher plans to measure the weights of 100 of these ducks sampled randomly. What is the probability the **sample mean** will be between 215.3 and 219.3 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Vireo philadelphicus*. She randomly samples 20 adults of *Vireo philadelphicus*, resulting in a sample mean of 13.5 grams and a sample standard deviation of 1.52 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 300 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 89 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
7.9	60	
5	57	
2	91	
7.2	54	
5.5	41	
3.5	72	
4.5	52	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

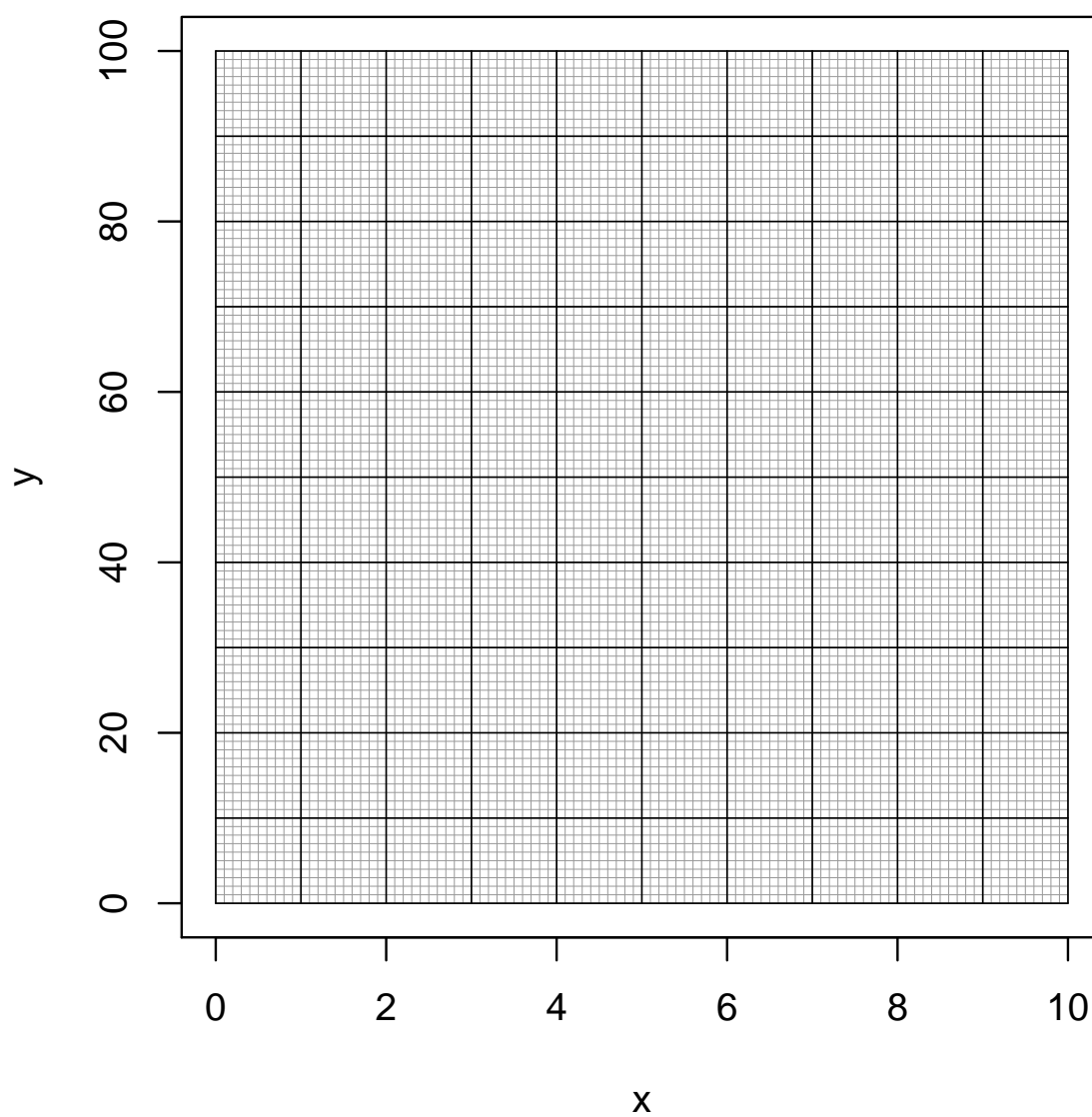
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.81$. If 195 trials occur, what is the probability of getting more than 145 but at most 166 successes?

In other words, let $X \sim \text{Bin}(n = 195, p = 0.81)$ and find $P(145 < X \leq 166)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 120$. You decide to run two-tail test on a sample of size $n = 8$ using a significance level $\alpha = 0.02$.

You then collect the sample:

121.1	127.3	123.1	118.2	124.1
123	121.4	123.3		

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

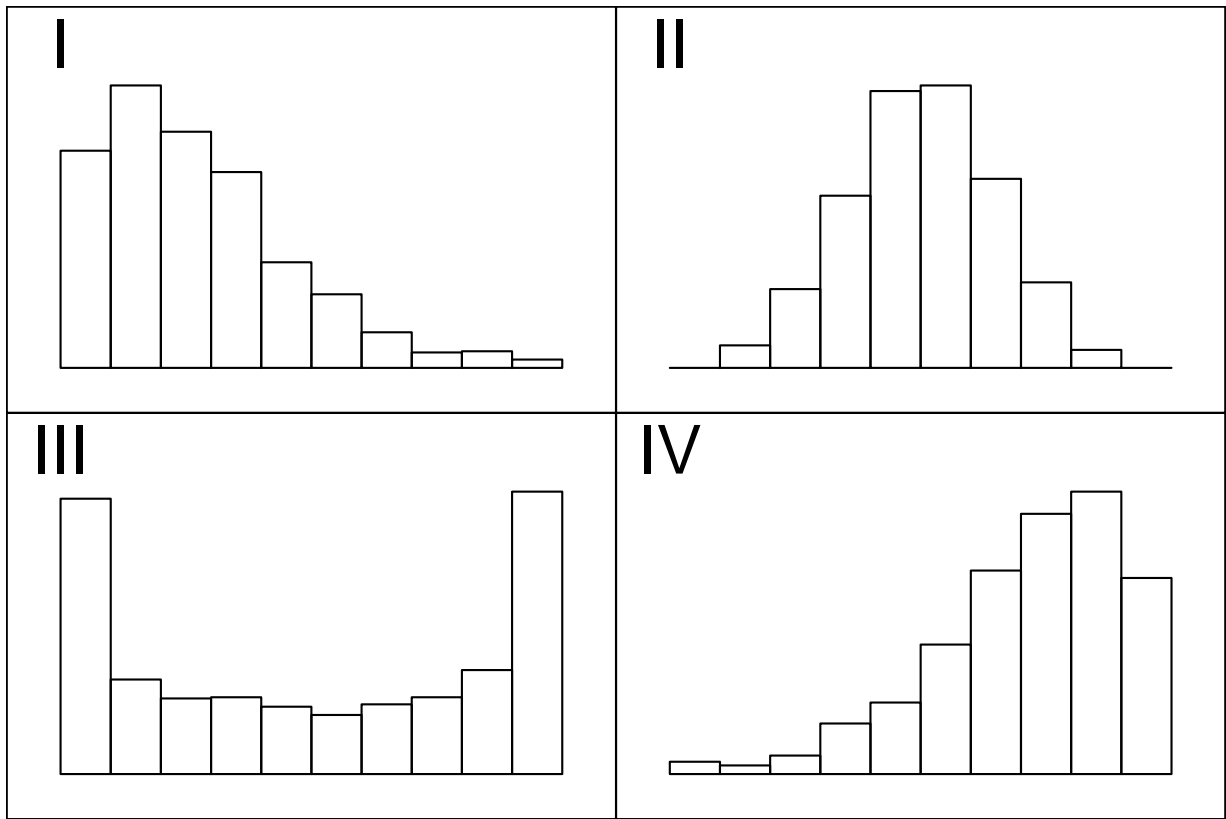
FINAL VERSION 018

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of lengths of newborn babies
- (b) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (c) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (d) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.

2. (15 Points)

In a deck of strange cards, there are 364 cards. Each card has an image and a color. The amounts are shown in the table below.

	pink	red	teal	white	Total
horn	38	50	40	32	160
pig	20	10	22	13	65
tree	45	35	43	16	139
Total	103	95	105	61	364

- (a) What is the probability a random card is a tree?
- (b) What is the probability a random card is pink given it is a horn?
- (c) What is the probability a random card is both a tree and red?
- (d) What is the probability a random card is a pig given it is red?
- (e) Is a horn or a tree more likely to be white?
- (f) What is the probability a random card is teal?
- (g) What is the probability a random card is either a pig or red (or both)?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	93	13
<i>B</i>	115	14
<i>C</i>	123	15
<i>D</i>	125	5

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	107.3
<i>B</i>	105.6
<i>C</i>	110.8
<i>D</i>	120

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 61.5 millimeters and a standard deviation of 8.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 45.3 and 66.8 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 163 grams and a standard deviation of 18 grams. A researcher plans to measure the weights of 81 of these ducks sampled randomly. What is the probability the **sample mean** will be between 159.5 and 162 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Zonotrichia albicollis*. She randomly samples 21 adults of *Zonotrichia albicollis*, resulting in a sample mean of 24.2 grams and a sample standard deviation of 1.91 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 400 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 218 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
95	2.1	
41	3.5	
16	6.3	
97	1.4	
34	1.7	
98	1.8	
73	5.5	
54	3.7	
69	2.3	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

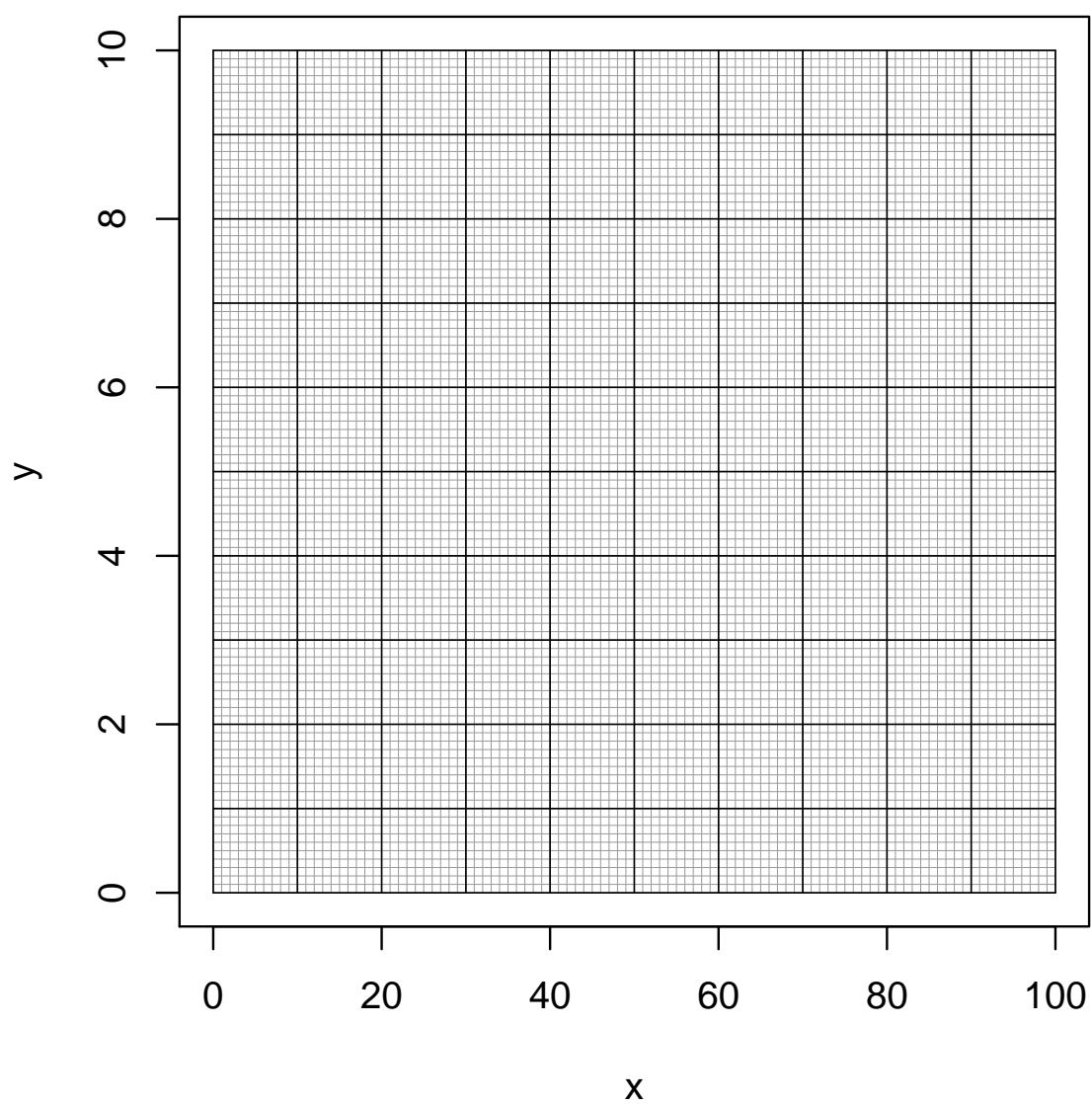
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.61$. If 132 trials occur, what is the probability of getting more than 77 but less than 88 successes?

In other words, let $X \sim \text{Bin}(n = 132, p = 0.61)$ and find $P(77 < X < 88)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 80$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.1$.

You then collect the sample:

112.7	73.7	99.6	112.3	93.6
73.4	81.1	85.7	93.5	68
76				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

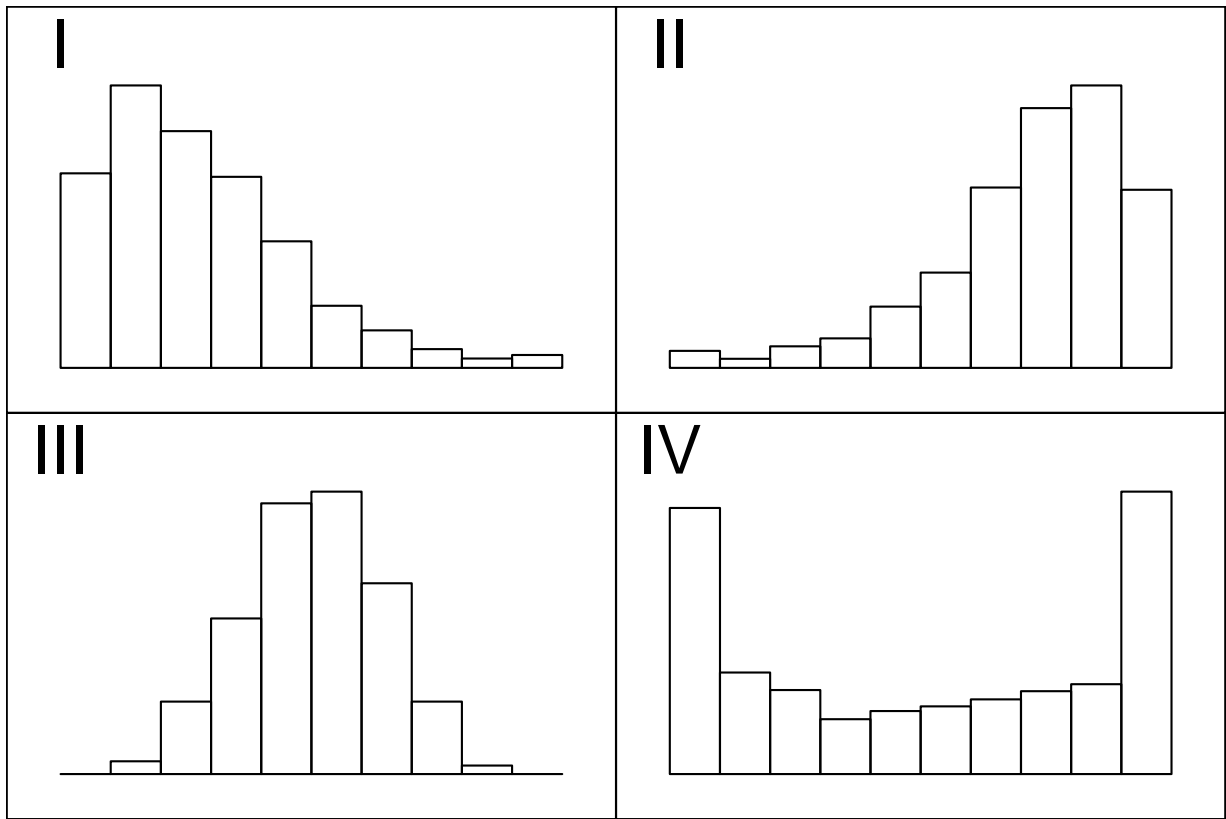
FINAL VERSION 019

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (b) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (c) The distribution of heights of adult men
- (d) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.

2. (15 Points)

In a deck of strange cards, there are 326 cards. Each card has an image and a color. The amounts are shown in the table below.

	green	red	yellow	Total
bike	39	15	30	84
cat	20	12	32	64
rug	42	23	13	78
wheel	25	49	26	100
Total	126	99	101	326

- (a) What is the probability a random card is yellow?
- (b) What is the probability a random card is both a cat and yellow?
- (c) What is the probability a random card is a bike given it is yellow?
- (d) What is the probability a random card is either a bike or red (or both)?
- (e) Is a bike or a wheel more likely to be yellow?
- (f) What is the probability a random card is a rug?
- (g) What is the probability a random card is green given it is a bike?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	89	11
<i>B</i>	141	9
<i>C</i>	99	4
<i>D</i>	62	15

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	98.02
<i>B</i>	135.3
<i>C</i>	98.92
<i>D</i>	62.6

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 103.9 millimeters and a standard deviation of 9.8 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 107.7 and 117.8 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 264.2 grams and a standard deviation of 16 grams. A researcher plans to measure the weights of 64 of these ducks sampled randomly. What is the probability the **sample mean** will be between 260.7 and 262.7 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Vireo griseus*. She randomly samples 21 adults of *Vireo griseus*, resulting in a sample mean of 10 grams and a sample standard deviation of 0.786 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 1000 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 527 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
41	69	
34	48	
41	40	
10	58	
54	49	
88	28	
33	60	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

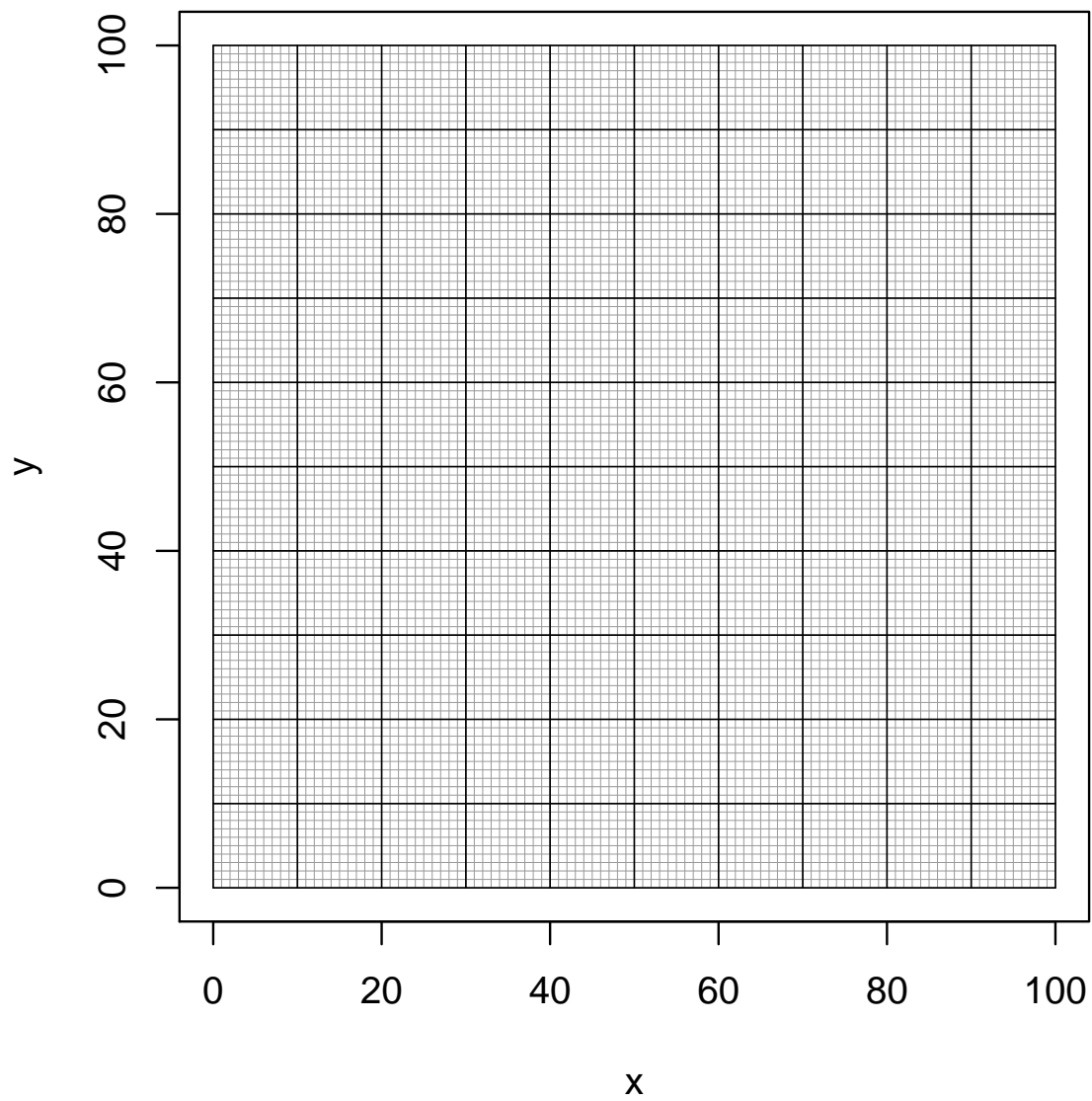
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.21$. If 213 trials occur, what is the probability of getting at least 32 but at most 57 successes?

In other words, let $X \sim \text{Bin}(n = 213, p = 0.21)$ and find $P(32 \leq X \leq 57)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 110$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.1$.

You then collect the sample:

109.2	111	109.5	113.9	124.2
116.3	114.2	111.3	102.3	128.7
114.4				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

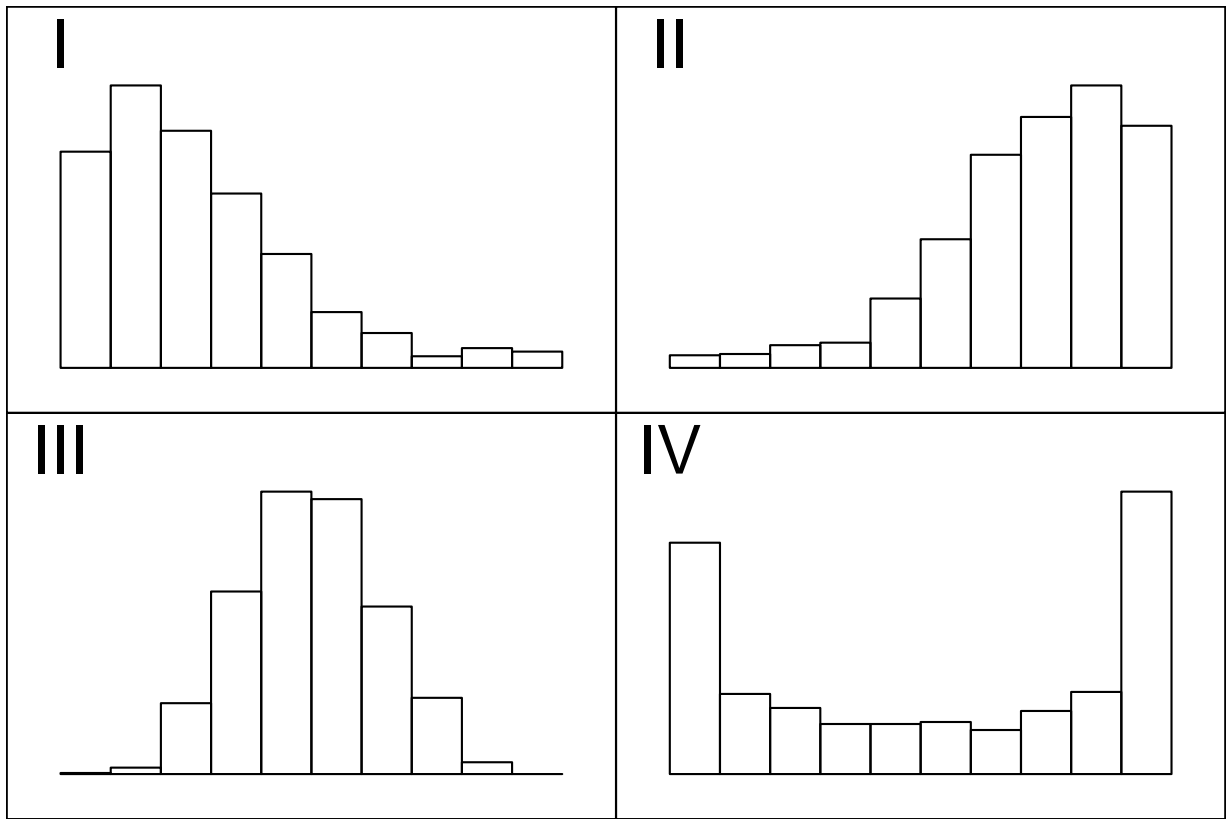
FINAL VERSION 020

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (b) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (c) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (d) The distribution of lengths of newborn babies

2. (15 Points)

In a deck of strange cards, there are 347 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	green	orange	violet	Total
kite	15	28	45	34	122
mop	14	25	44	22	105
wheel	16	43	11	50	120
Total	45	96	100	106	347

- (a) What is the probability a random card is a kite?
- (b) Is a mop or a wheel more likely to be green?
- (c) What is the probability a random card is either a wheel or violet (or both)?
- (d) What is the probability a random card is a mop given it is black?
- (e) What is the probability a random card is violet?
- (f) What is the probability a random card is orange given it is a kite?
- (g) What is the probability a random card is both a mop and violet?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	64	7
<i>B</i>	88	11
<i>C</i>	71	12
<i>D</i>	65	4

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	75.2
<i>B</i>	72.27
<i>C</i>	71.72
<i>D</i>	61.84

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 143.8 millimeters and a standard deviation of 2.8 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 136.9 and 146.5 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 223.7 grams and a standard deviation of 44 grams. A researcher plans to measure the weights of 121 of these ducks sampled randomly. What is the probability the **sample mean** will be between 220.7 and 225.7 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus ustulatus*. She randomly samples 14 adults of *Catharus ustulatus*, resulting in a sample mean of 32.68 grams and a sample standard deviation of 7.38 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 900 questions. Each question has 3 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 326 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
790	7	
420	6.1	
440	6.8	
180	5.9	
230	5.9	
520	5.6	
960	8.3	
720	6.6	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

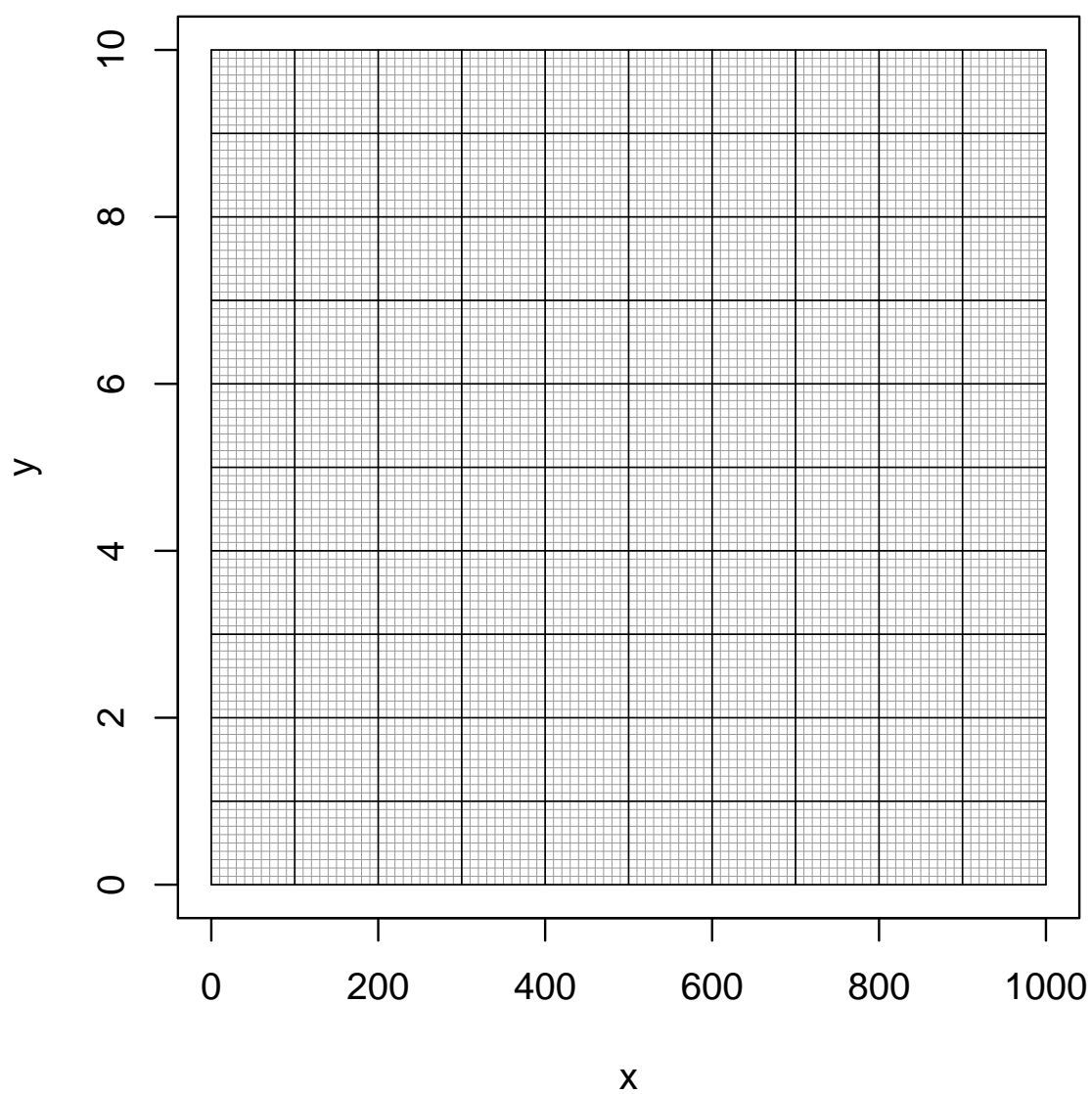
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.85$. If 218 trials occur, what is the probability of getting at least 184 but at most 198 successes?

In other words, let $X \sim \text{Bin}(n = 218, p = 0.85)$ and find $P(184 \leq X \leq 198)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 100$. You decide to run two-tail test on a sample of size $n = 10$ using a significance level $\alpha = 0.1$.

You then collect the sample:

129.3	87.8	119.1	122.9	107.6
101.2	104.8	101.4	128.1	85.8

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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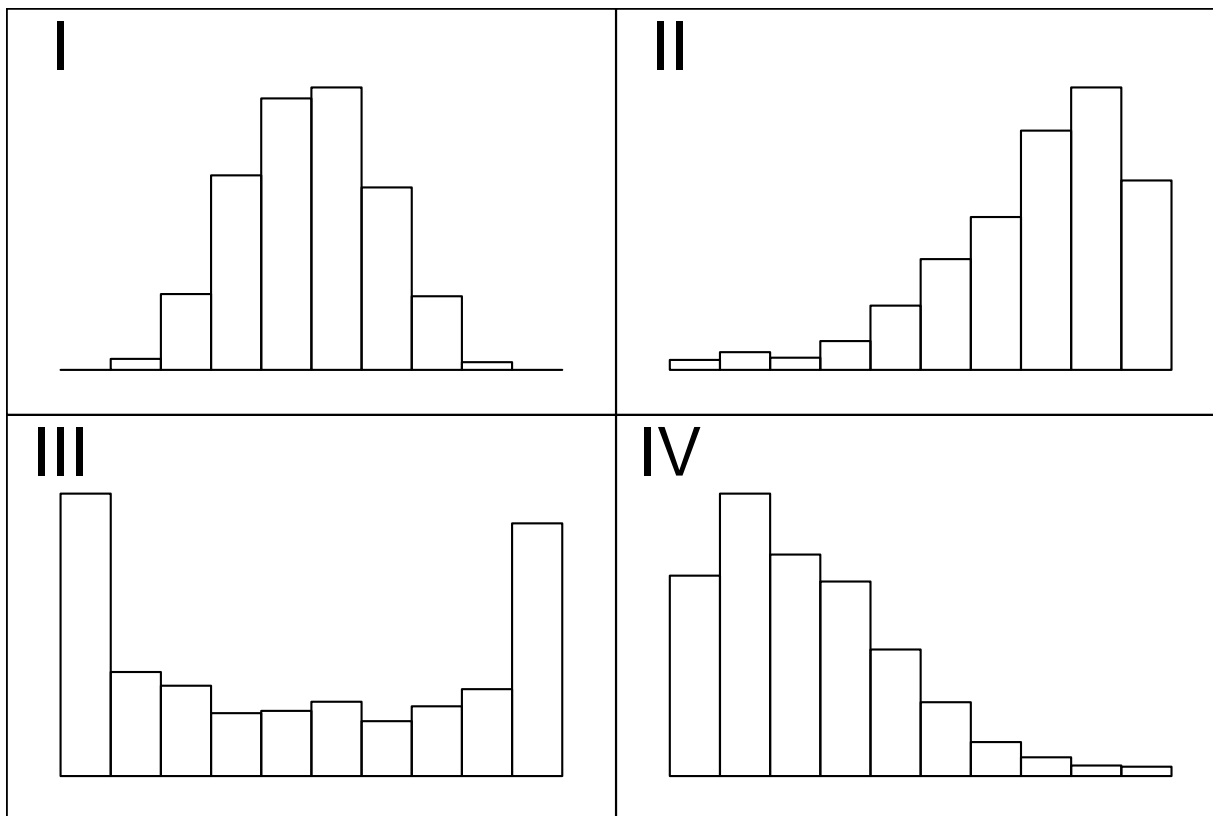
FINAL VERSION 021

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (b) The distribution of heights of adult women
- (c) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (d) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.

2. (15 Points)

In a deck of strange cards, there are 449 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	gray	orange	white	Total
dog	42	34	21	26	123
flower	45	29	18	50	142
gem	44	19	23	43	129
wheel	13	12	16	14	55
Total	144	94	78	133	449

- (a) What is the probability a random card is gray?
- (b) Is a gem or a wheel more likely to be orange?
- (c) What is the probability a random card is orange given it is a gem?
- (d) What is the probability a random card is a dog?
- (e) What is the probability a random card is both a dog and white?
- (f) What is the probability a random card is a wheel given it is white?
- (g) What is the probability a random card is either a dog or white (or both)?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	116	4
<i>B</i>	146	5
<i>C</i>	67	11
<i>D</i>	143	6

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	113
<i>B</i>	143.7
<i>C</i>	67
<i>D</i>	146.5

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 103 millimeters and a standard deviation of 8.2 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 82.6 and 107.3 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 226.1 grams and a standard deviation of 20 grams. A researcher plans to measure the weights of 64 of these ducks sampled randomly. What is the probability the **sample mean** will be between 223.6 and 227.6 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Icterus spurius*. She randomly samples 35 adults of *Icterus spurius*, resulting in a sample mean of 21.67 grams and a sample standard deviation of 2.26 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 700 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 156 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
8.3	51	
4.5	88	
2	98	
4.1	43	
1.9	94	
2.1	86	
9.1	76	
1.5	76	
5.4	39	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

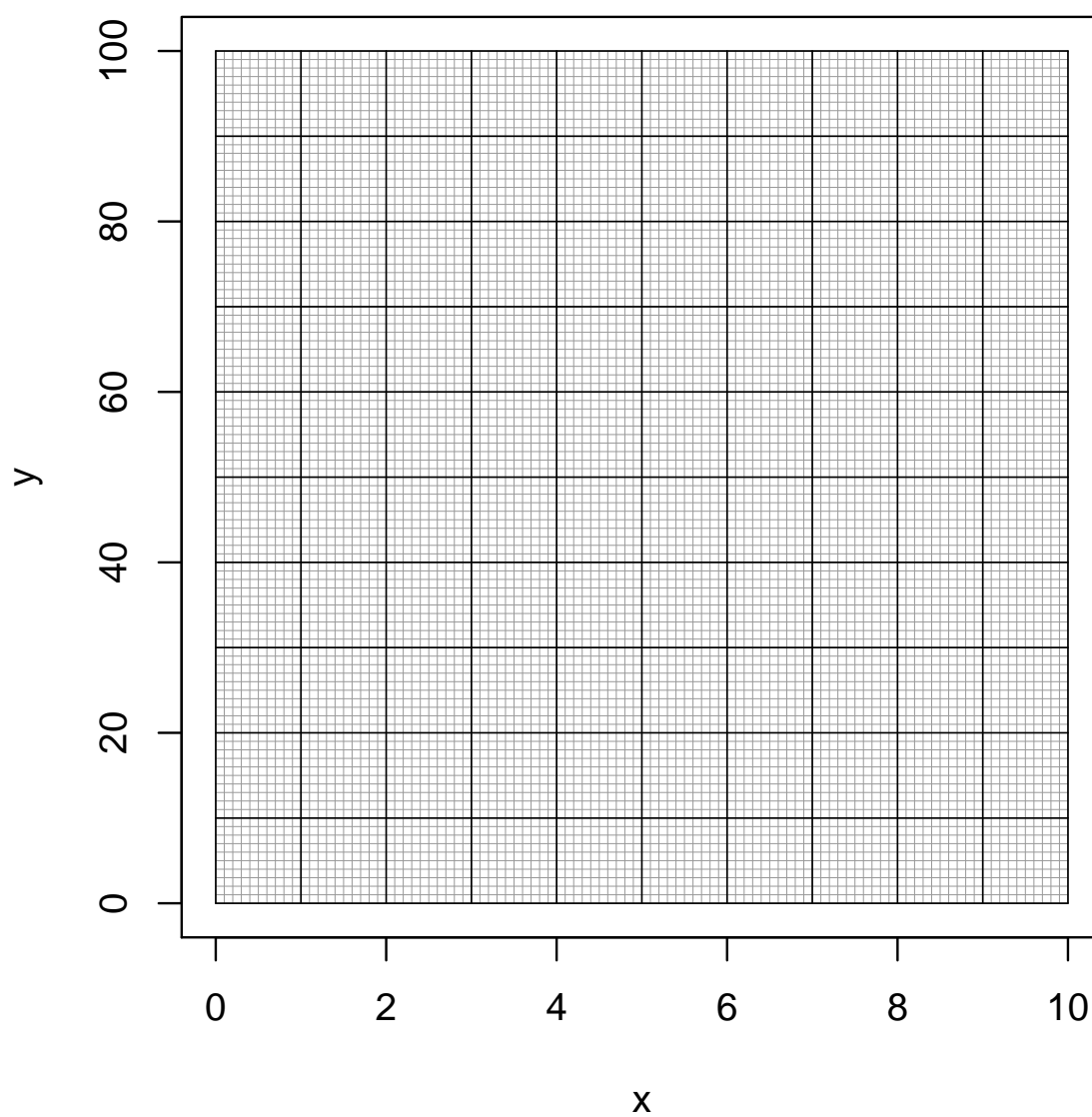
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.15$. If 162 trials occur, what is the probability of getting more than 16 but less than 35 successes?

In other words, let $X \sim \text{Bin}(n = 162, p = 0.15)$ and find $P(16 < X < 35)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 90$. You decide to run two-tail test on a sample of size $n = 10$ using a significance level $\alpha = 0.1$.

You then collect the sample:

108.3	117	91.5	83.2	113.8
69.3	123.6	127.4	120.2	68.5

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

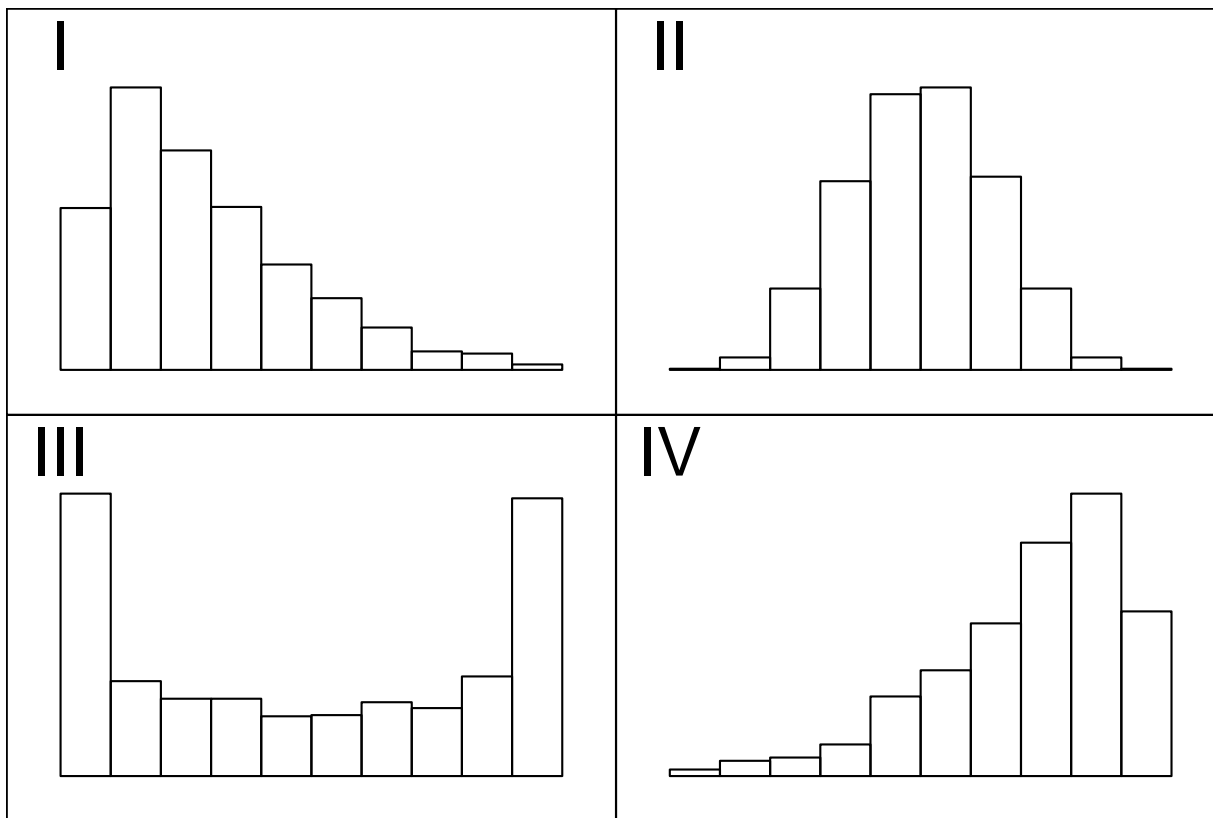
FINAL VERSION 022

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (d) The distribution of heights of adult men

2. (15 Points)

In a deck of strange cards, there are 440 cards. Each card has an image and a color. The amounts are shown in the table below.

	indigo	red	violet	Total
dog	49	11	22	82
horn	21	38	42	101
needle	48	14	13	75
quilt	19	23	36	78
shovel	30	29	45	104
Total	167	115	158	440

- (a) What is the probability a random card is red given it is a shovel?
- (b) What is the probability a random card is both a horn and red?
- (c) What is the probability a random card is a quilt?
- (d) What is the probability a random card is either a quilt or violet (or both)?
- (e) Is a horn or a needle more likely to be red?
- (f) What is the probability a random card is a needle given it is indigo?
- (g) What is the probability a random card is red?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	98	7
<i>B</i>	146	6
<i>C</i>	149	10
<i>D</i>	102	8

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	91.14
<i>B</i>	150.7
<i>C</i>	149.2
<i>D</i>	101.2

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 33.4 millimeters and a standard deviation of 7.1 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 23.7 and 36 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 268.2 grams and a standard deviation of 17.5 grams. A researcher plans to measure the weights of 49 of these ducks sampled randomly. What is the probability the **sample mean** will be between 268.2 and 273.7 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus minimus*. She randomly samples 15 adults of *Catharus minimus*, resulting in a sample mean of 31.23 grams and a sample standard deviation of 4.94 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 800 questions. Each question has 3 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 286 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
9	530	
1.3	540	
5.4	300	
4.6	550	
7.4	440	
1.1	950	
5.1	500	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

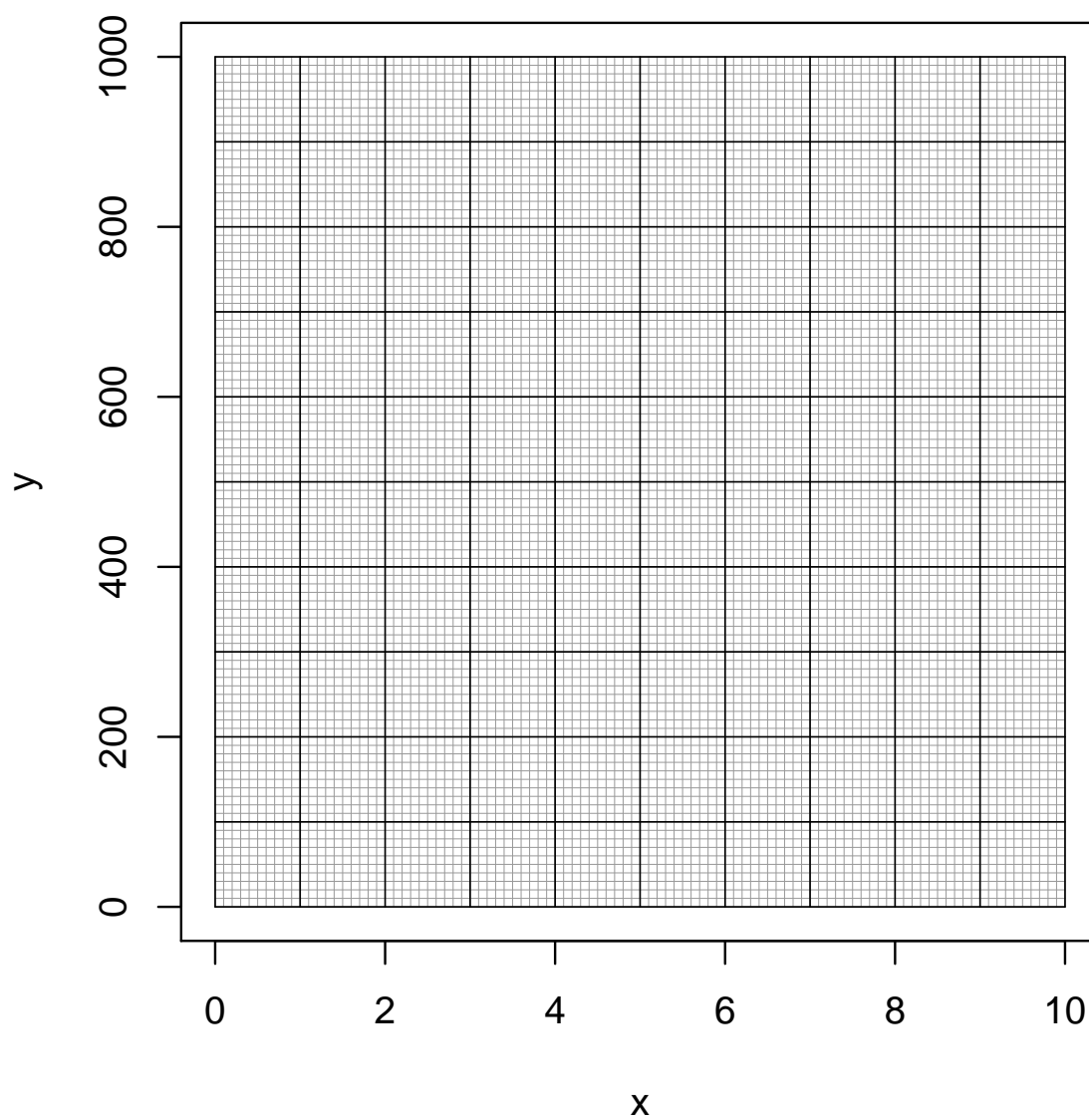
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.77$. If 165 trials occur, what is the probability of getting at least 121 but at most 130 successes?

In other words, let $X \sim \text{Bin}(n = 165, p = 0.77)$ and find $P(121 \leq X \leq 130)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 150$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.05$.

You then collect the sample:

149.5	153.8	149.1	155.3	162.2
149.6	150.9	153.6	148.6	152.2
153				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

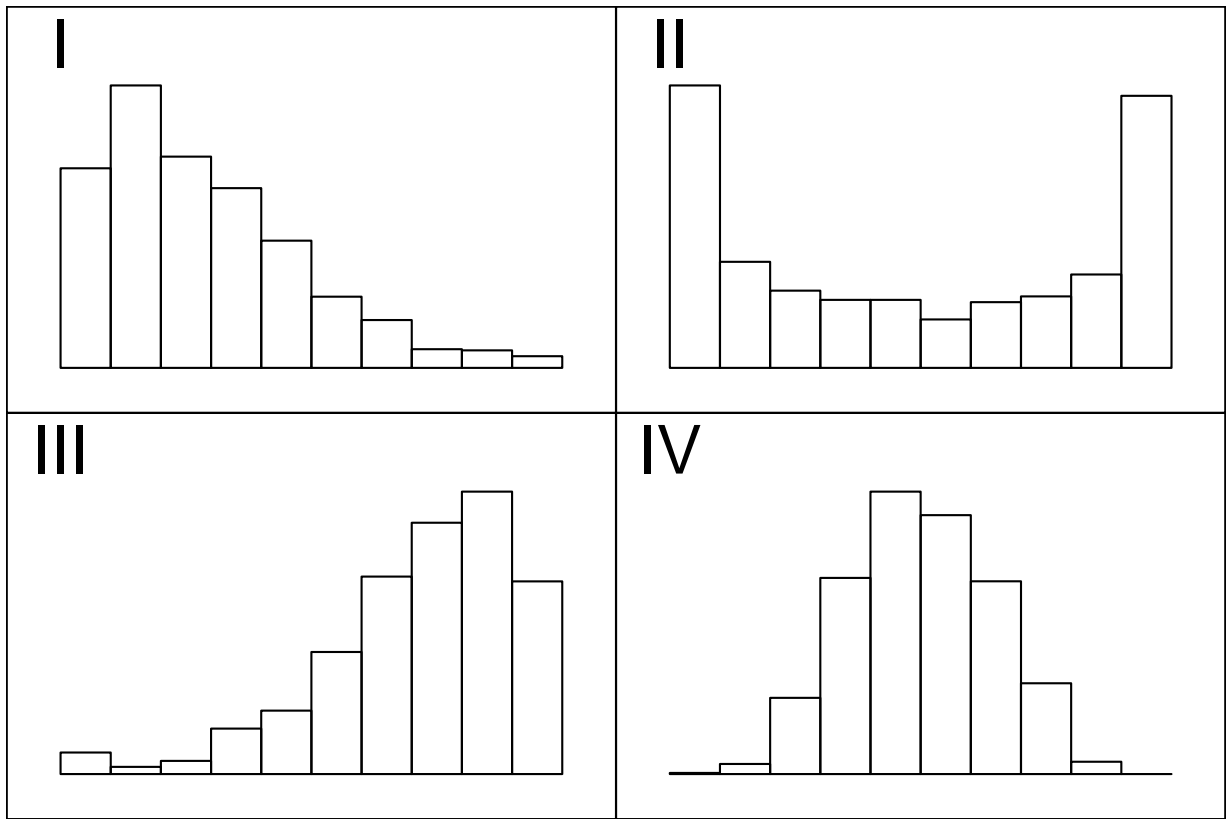
FINAL VERSION 023

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of heights of adult women
- (d) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.

2. (15 Points)

In a deck of strange cards, there are 374 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	gray	red	Total
horn	39	20	14	73
jigsaw	11	24	30	65
needle	19	34	36	89
pig	15	43	13	71
shovel	12	26	38	76
Total	96	147	131	374

- (a) What is the probability a random card is either a jigsaw or gray (or both)?
- (b) What is the probability a random card is both a shovel and gray?
- (c) Is a horn or a shovel more likely to be red?
- (d) What is the probability a random card is blue given it is a jigsaw?
- (e) What is the probability a random card is a pig?
- (f) What is the probability a random card is a jigsaw given it is red?
- (g) What is the probability a random card is gray?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	92	9
<i>B</i>	96	11
<i>C</i>	103	6
<i>D</i>	77	4

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	95.87
<i>B</i>	105.6
<i>C</i>	107
<i>D</i>	78.6

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 161.5 millimeters and a standard deviation of 3.7 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 162.9 and 166.6 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 200.7 grams and a standard deviation of 67.5 grams. A researcher plans to measure the weights of 81 of these ducks sampled randomly. What is the probability the **sample mean** will be between 205.2 and 215.7 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Piranga rubra*. She randomly samples 32 adults of *Piranga rubra*, resulting in a sample mean of 36.13 grams and a sample standard deviation of 7.1 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 800 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 426 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
2	71	
6.7	16	
8.7	9.1	
9.6	5.5	
9.3	26	
4.2	22	
7	11	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

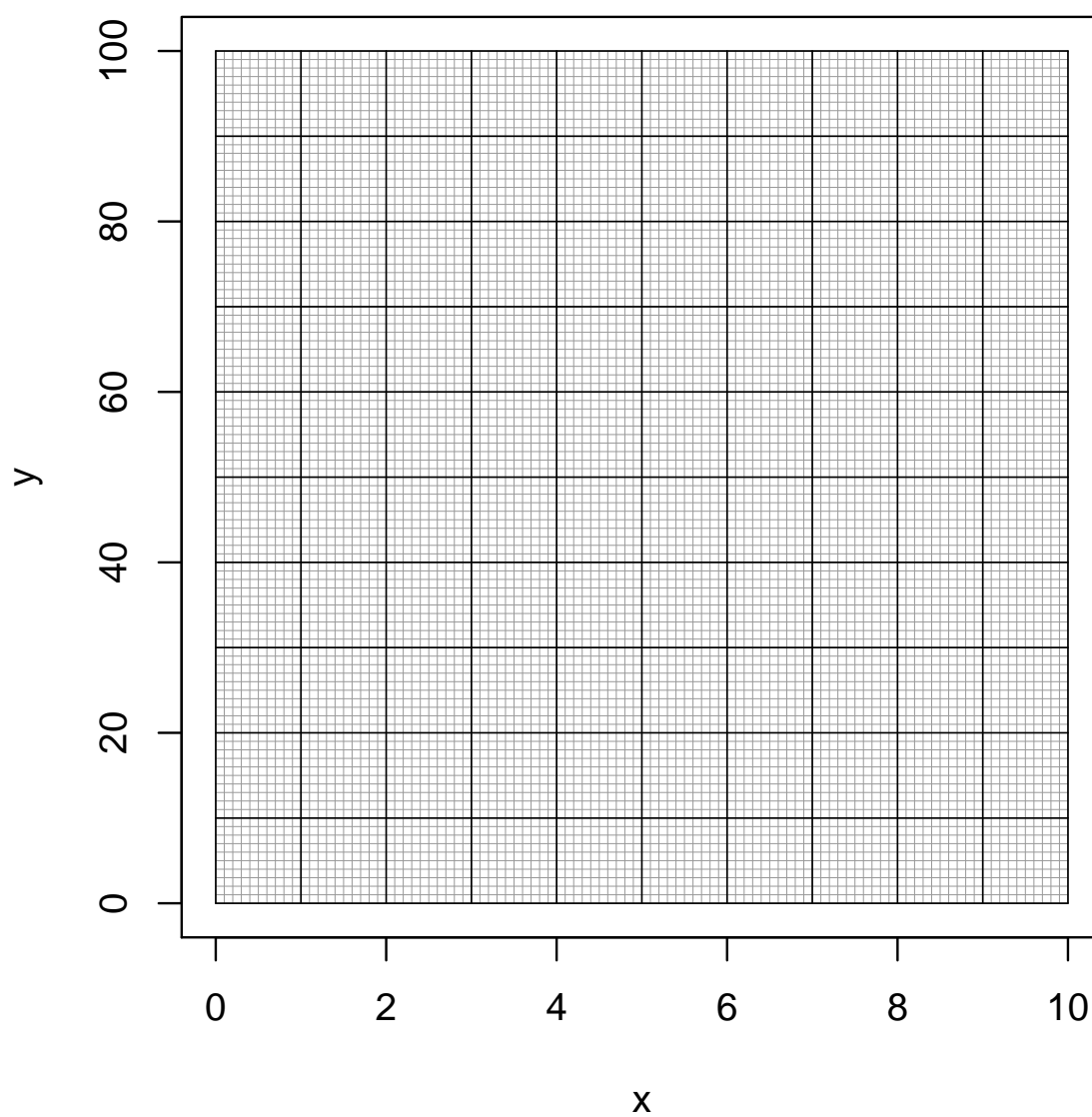
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.19$. If 185 trials occur, what is the probability of getting at least 37 but at most 43 successes?

In other words, let $X \sim \text{Bin}(n = 185, p = 0.19)$ and find $P(37 \leq X \leq 43)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 80$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.02$.

You then collect the sample:

79.6	80.9	82.7	79.4	83
85.3	81	82.5	81.5	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

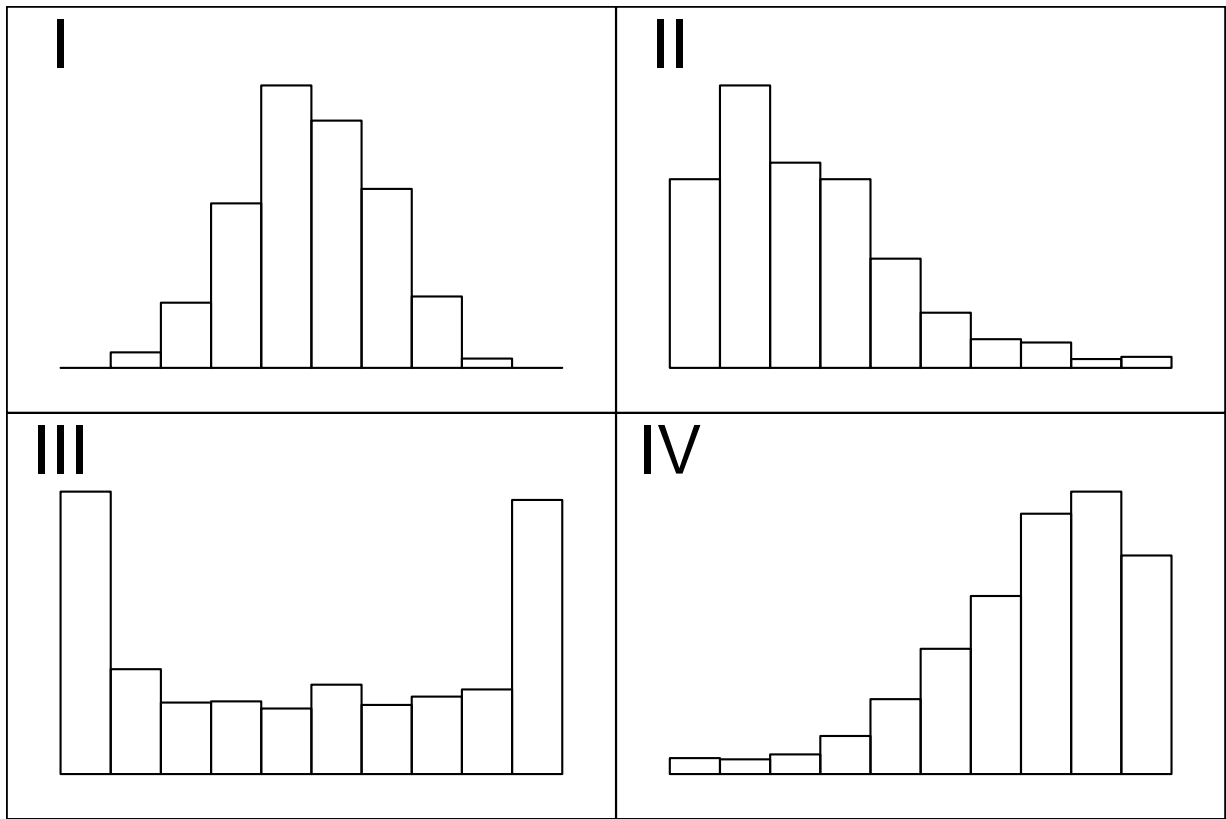
FINAL VERSION 024

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (b) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (c) The distribution of heights of adult women
- (d) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.

2. (15 Points)

In a deck of strange cards, there are 418 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	green	indigo	orange	yellow	Total
bike	22	45	33	15	40	155
jigsaw	36	41	13	18	12	120
mop	19	31	25	39	29	143
Total	77	117	71	72	81	418

- (a) What is the probability a random card is orange given it is a mop?
- (b) What is the probability a random card is a jigsaw given it is indigo?
- (c) What is the probability a random card is either a jigsaw or yellow (or both)?
- (d) Is a bike or a jigsaw more likely to be orange?
- (e) What is the probability a random card is indigo?
- (f) What is the probability a random card is both a mop and orange?
- (g) What is the probability a random card is a mop?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	86	11
<i>B</i>	138	5
<i>C</i>	84	15
<i>D</i>	126	13

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	71.92
<i>B</i>	143.1
<i>C</i>	59.4
<i>D</i>	113.8

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 60.2 millimeters and a standard deviation of 7.9 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 64.8 and 72.7 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 195.7 grams and a standard deviation of 28 grams. A researcher plans to measure the weights of 49 of these ducks sampled randomly. What is the probability the **sample mean** will be between 191.7 and 199.7 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Dendroica dominica*. She randomly samples 25 adults of *Dendroica dominica*, resulting in a sample mean of 9.22 grams and a sample standard deviation of 1.62 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 300 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 166 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
930	64	
950	61	
500	75	
570	72	
460	78	
630	66	
230	83	
870	67	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

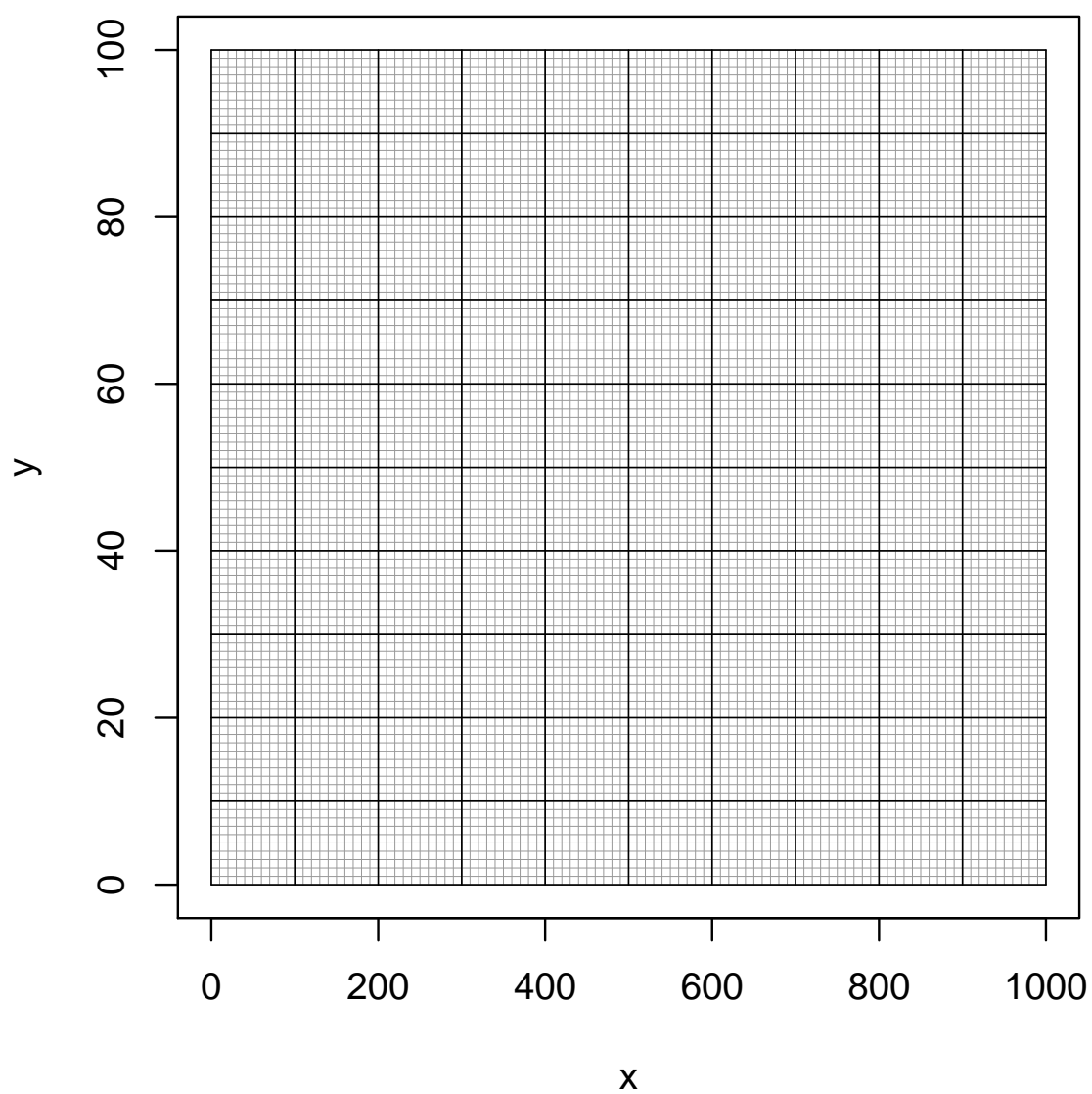
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.19$. If 211 trials occur, what is the probability of getting more than 30 but at most 40 successes?

In other words, let $X \sim \text{Bin}(n = 211, p = 0.19)$ and find $P(30 < X \leq 40)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 220$. You decide to run two-tail test on a sample of size $n = 11$ using a significance level $\alpha = 0.1$.

You then collect the sample:

264.7	283.1	262.6	138.7	265.2
214.9	230.8	292.7	221.8	226.4
293.2				

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

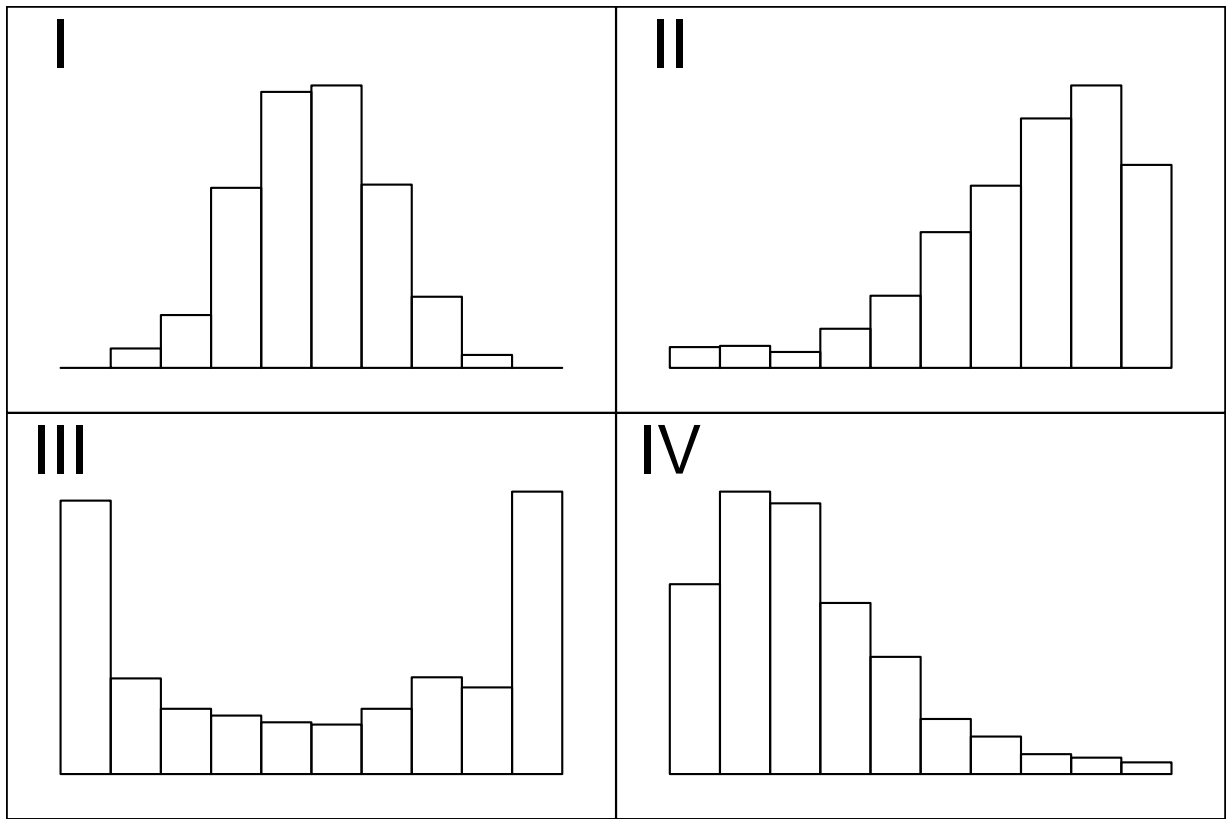
FINAL VERSION 025

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.
- (b) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (c) The distribution of heights of adult women
- (d) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.

2. (15 Points)

In a deck of strange cards, there are 752 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	indigo	orange	teal	yellow	Total
cat	14	26	35	25	33	133
lamp	24	37	48	18	42	169
needle	15	41	10	22	13	101
shovel	28	27	40	50	36	181
wheel	31	45	19	34	39	168
Total	112	176	152	149	163	752

(a) What is the probability a random card is either a wheel or orange (or both)?

(b) What is the probability a random card is orange?

(c) What is the probability a random card is both a lamp and gray?

(d) What is the probability a random card is gray given it is a shovel?

(e) What is the probability a random card is a lamp given it is indigo?

(f) Is a needle or a wheel more likely to be indigo?

(g) What is the probability a random card is a lamp?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	89	7
<i>B</i>	115	5
<i>C</i>	90	14
<i>D</i>	133	9

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	88.16
<i>B</i>	119.9
<i>C</i>	101.6
<i>D</i>	127.3

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 151.4 millimeters and a standard deviation of 9.3 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 129.2 and 145.3 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 133.9 grams and a standard deviation of 48 grams. A researcher plans to measure the weights of 144 of these ducks sampled randomly. What is the probability the **sample mean** will be between 132.9 and 134.9 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Melospiza georgiana*. She randomly samples 28 adults of *Melospiza georgiana*, resulting in a sample mean of 13.66 grams and a sample standard deviation of 1.07 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 1000 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 224 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
7.7	45	
6.3	23	
2	58	
4.1	65	
2.7	97	
8.2	44	
8.5	36	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

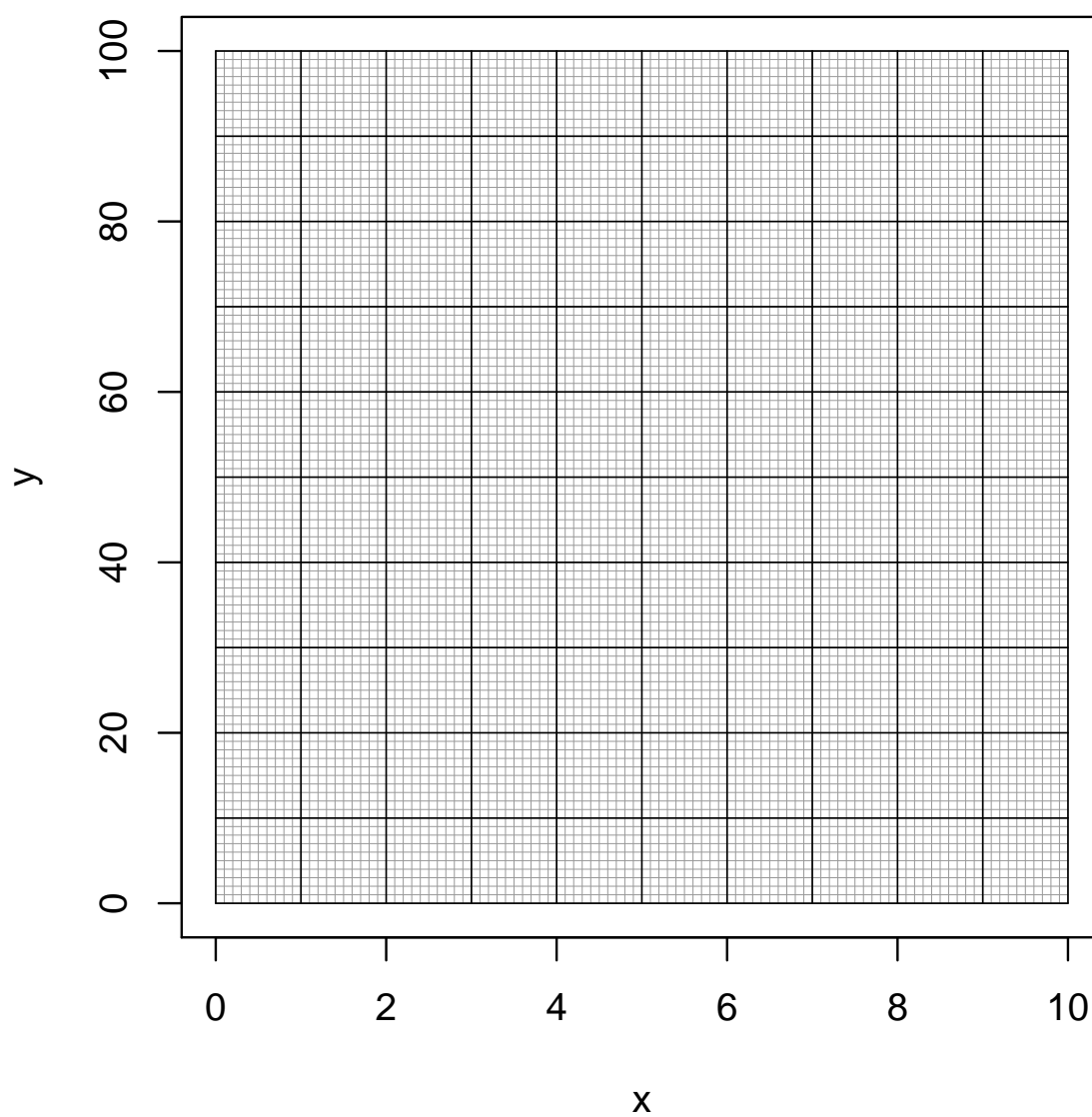
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.92$. If 164 trials occur, what is the probability of getting at least 147 but at most 155 successes?

In other words, let $X \sim \text{Bin}(n = 164, p = 0.92)$ and find $P(147 \leq X \leq 155)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 90$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.02$.

You then collect the sample:

92.9	88.3	91.2	92.2	100.4
98.8	102.9	91.7	93.5	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

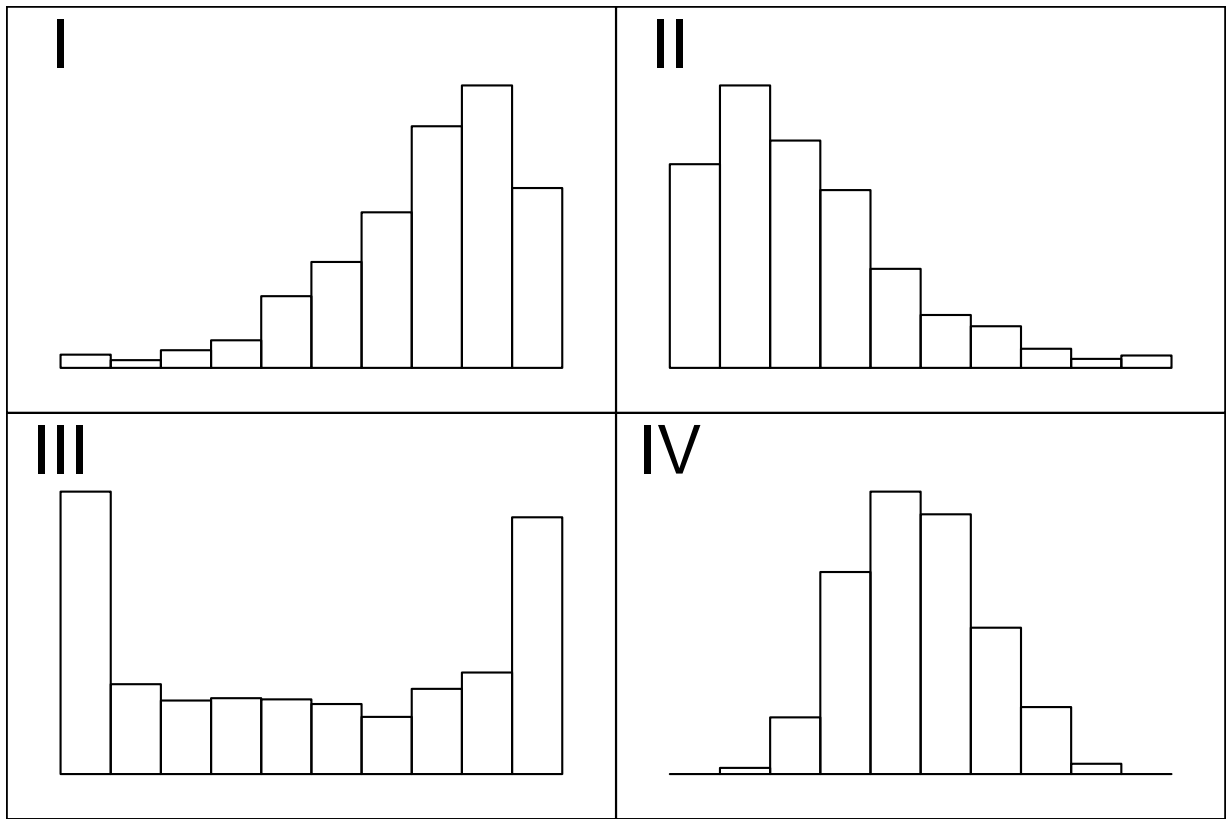
FINAL VERSION 026

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (b) The distribution of weights of newborn babies
- (c) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.
- (d) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.

2. (15 Points)

In a deck of strange cards, there are 420 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	gray	indigo	white	yellow	Total
horn	46	10	13	44	29	142
lamp	31	18	21	14	39	123
mop	11	47	15	45	37	155
Total	88	75	49	103	105	420

- (a) What is the probability a random card is blue?
- (b) What is the probability a random card is both a mop and yellow?
- (c) What is the probability a random card is a mop given it is blue?
- (d) What is the probability a random card is a mop?
- (e) What is the probability a random card is either a horn or gray (or both)?
- (f) What is the probability a random card is blue given it is a horn?
- (g) Is a lamp or a mop more likely to be white?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	71	7
<i>B</i>	73	4
<i>C</i>	60	14
<i>D</i>	110	6

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	77.51
<i>B</i>	70.92
<i>C</i>	64.76
<i>D</i>	106.3

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 30.5 millimeters and a standard deviation of 2.6 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 24.2 and 29.6 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 217.1 grams and a standard deviation of 25 grams. A researcher plans to measure the weights of 100 of these ducks sampled randomly. What is the probability the **sample mean** will be between 212.6 and 216.6 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Catharus fuscescens*. She randomly samples 16 adults of *Catharus fuscescens*, resulting in a sample mean of 42.97 grams and a sample standard deviation of 3.95 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 500 questions. Each question has 5 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 115 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
860	74	
120	28	
820	68	
340	22	
470	48	
960	67	
260	30	
120	25	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

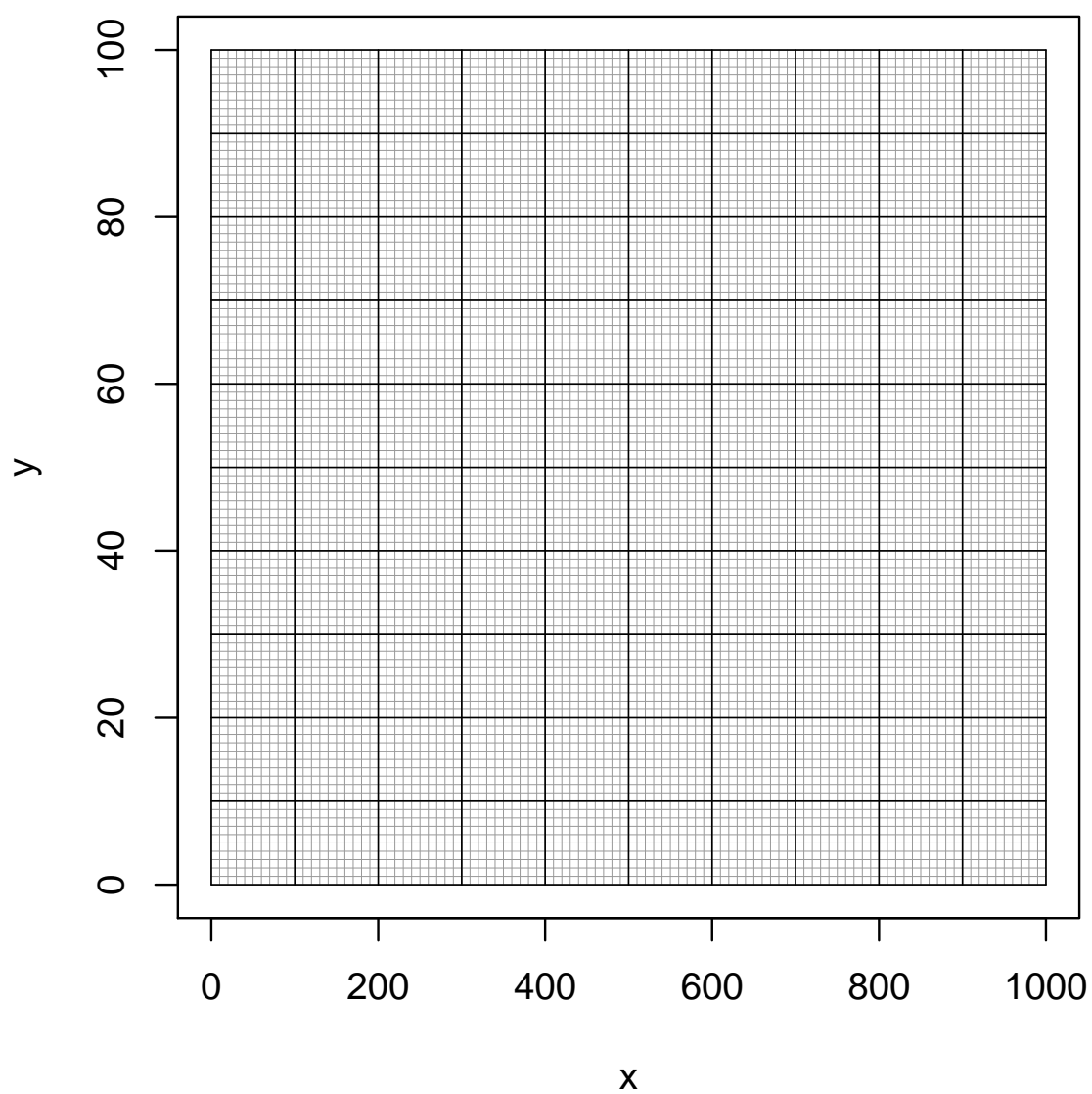
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.81$. If 238 trials occur, what is the probability of getting at least 188 but at most 199 successes?

In other words, let $X \sim \text{Bin}(n = 238, p = 0.81)$ and find $P(188 \leq X \leq 199)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 90$. You decide to run two-tail test on a sample of size $n = 12$ using a significance level $\alpha = 0.05$.

You then collect the sample:

99.1	98.1	90.5	99.8	88.7
85	108.8	115.6	97.8	99.9
79.6	92.1			

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

NAME:

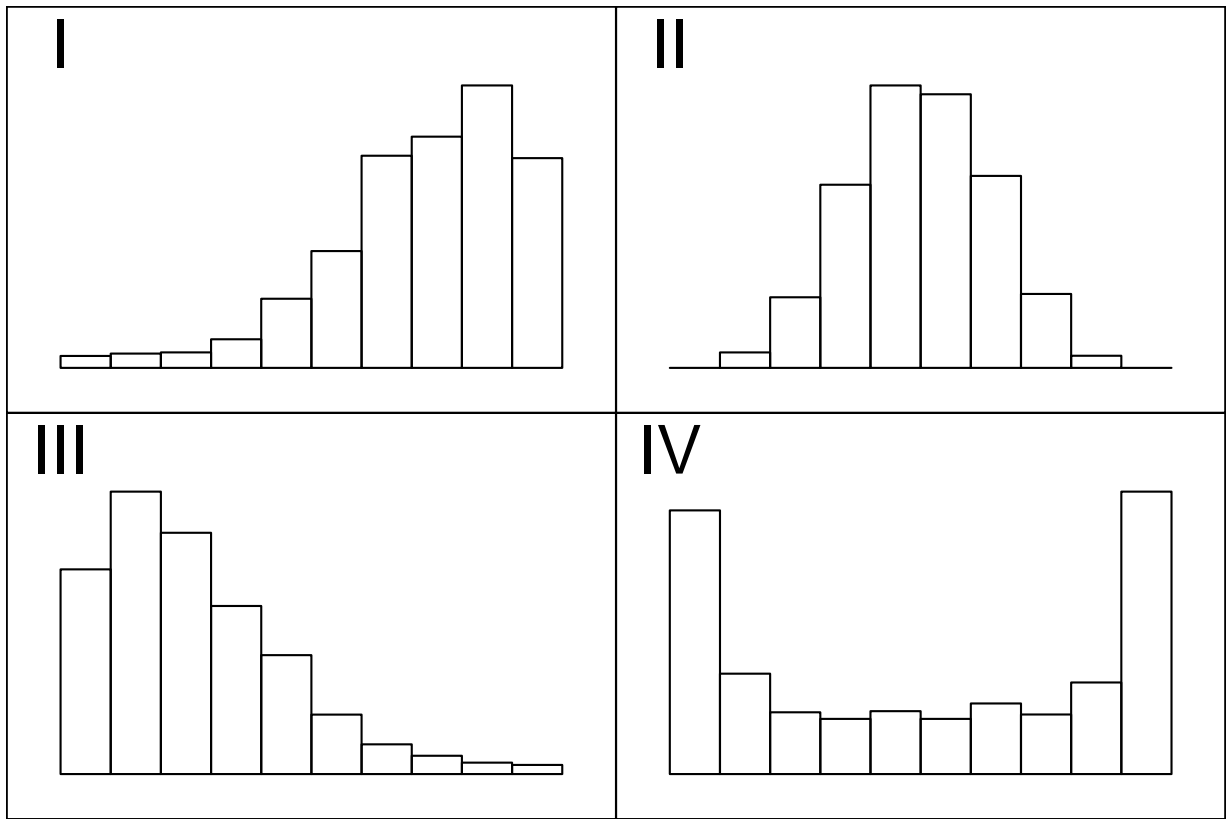
FINAL VERSION 027

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (b) The distribution of heights of adult men
- (c) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (d) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.

2. (15 Points)

In a deck of strange cards, there are 515 cards. Each card has an image and a color. The amounts are shown in the table below.

	pink	violet	white	Total
kite	28	37	15	80
lamp	46	10	43	99
needle	45	41	34	120
pig	32	47	44	123
tree	18	26	49	93
Total	169	161	185	515

- (a) What is the probability a random card is pink?
- (b) What is the probability a random card is both a needle and violet?
- (c) What is the probability a random card is violet given it is a lamp?
- (d) What is the probability a random card is a tree?
- (e) Is a kite or a lamp more likely to be white?
- (f) What is the probability a random card is a needle given it is white?
- (g) What is the probability a random card is either a lamp or violet (or both)?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	72	5
<i>B</i>	149	13
<i>C</i>	77	8
<i>D</i>	133	9

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	76.75
<i>B</i>	166.7
<i>C</i>	76.76
<i>D</i>	147.4

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 47.6 millimeters and a standard deviation of 8.8 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 43.3 and 55.9 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 215.3 grams and a standard deviation of 70 grams. A researcher plans to measure the weights of 196 of these ducks sampled randomly. What is the probability the **sample mean** will be between 204.8 and 208.3 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Dendroica fusca*. She randomly samples 19 adults of *Dendroica fusca*, resulting in a sample mean of 13.1 grams and a sample standard deviation of 1.51 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 300 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 166 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
44	4.3	
85	4.8	
83	5.4	
28	3.1	
46	3.8	
62	5.1	
93	4.8	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

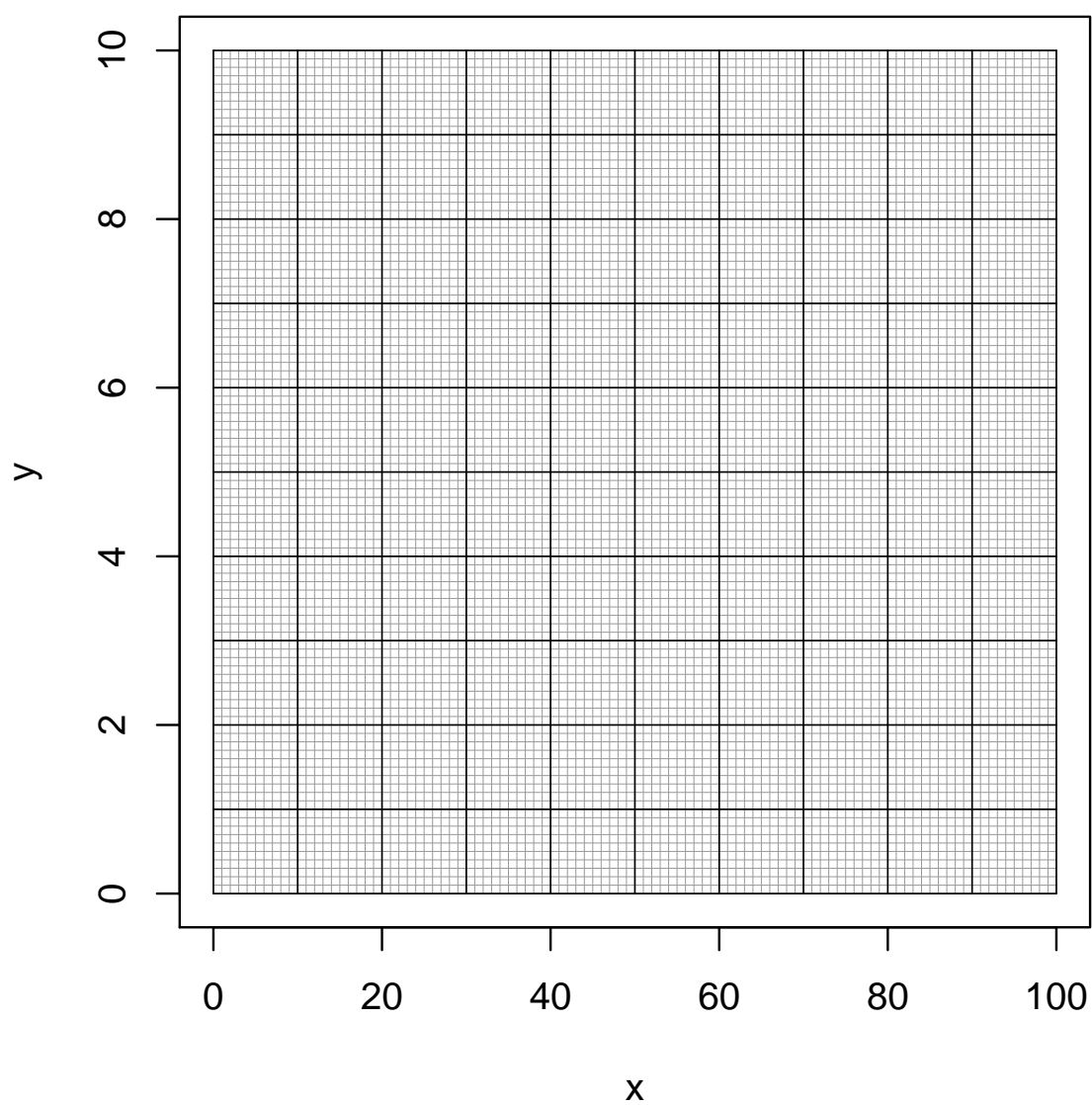
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.76$. If 180 trials occur, what is the probability of getting more than 131 but at most 141 successes?

In other words, let $X \sim \text{Bin}(n = 180, p = 0.76)$ and find $P(131 < X \leq 141)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 120$. You decide to run two-tail test on a sample of size $n = 10$ using a significance level $\alpha = 0.05$.

You then collect the sample:

187.6	135.5	107.8	116.2	125.1
146.3	164	152.3	109	131.9

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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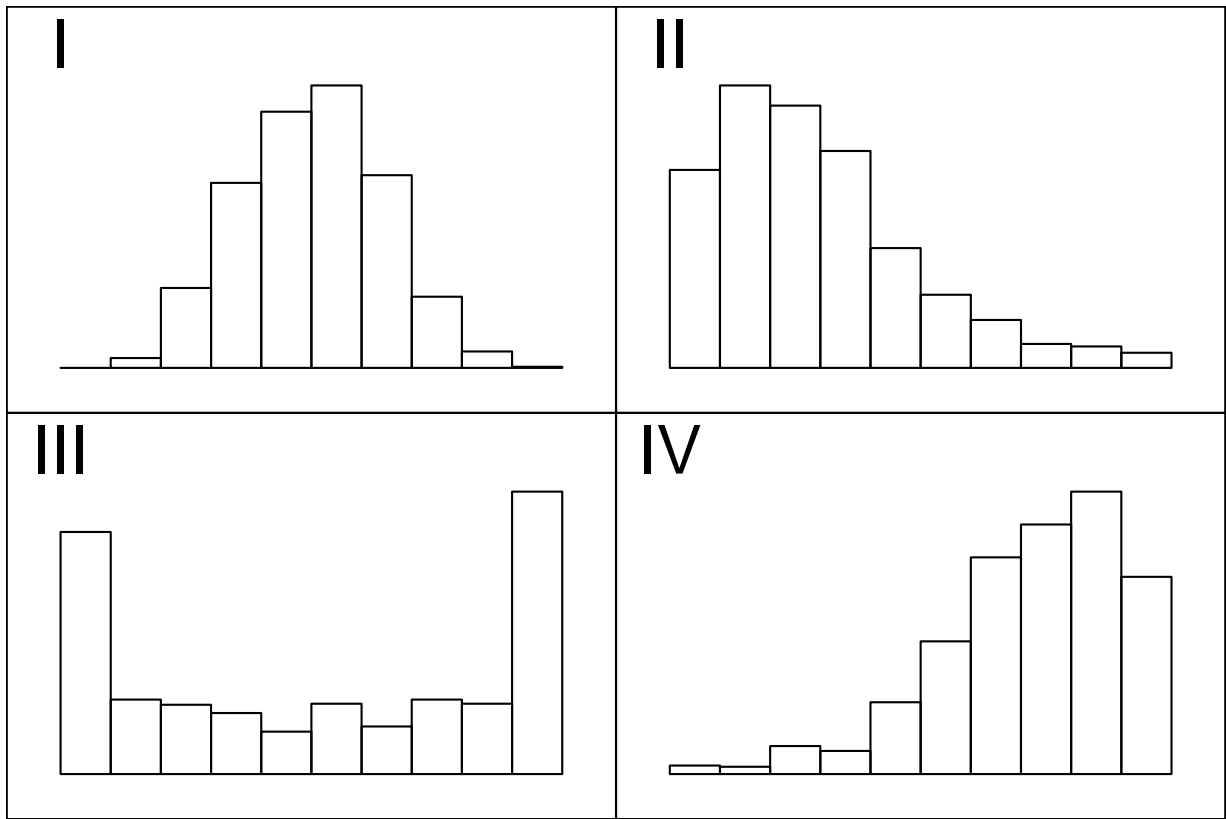
FINAL VERSION 028

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of weights of newborn babies
- (b) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.
- (c) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (d) The distribution of annual income for school employees where a high percentage of employees are entry-level teachers and only a few are high-paid administrators.

2. (15 Points)

In a deck of strange cards, there are 415 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	gray	green	pink	teal	Total
jigsaw	45	12	10	38	33	138
tree	19	29	30	35	28	141
wheel	21	48	27	24	16	136
Total	85	89	67	97	77	415

- (a) What is the probability a random card is both a wheel and green?
- (b) Is a jigsaw or a wheel more likely to be blue?
- (c) What is the probability a random card is a wheel?
- (d) What is the probability a random card is green given it is a wheel?
- (e) What is the probability a random card is either a wheel or green (or both)?
- (f) What is the probability a random card is a tree given it is pink?
- (g) What is the probability a random card is pink?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	113	5
<i>B</i>	134	4
<i>C</i>	133	13
<i>D</i>	99	7

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	112.2
<i>B</i>	136.6
<i>C</i>	138.7
<i>D</i>	97.11

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 69.7 millimeters and a standard deviation of 9.5 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 53.1 and 89.8 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 171.6 grams and a standard deviation of 72 grams. A researcher plans to measure the weights of 64 of these ducks sampled randomly. What is the probability the **sample mean** will be between 158.1 and 162.6 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Archilochus colubris*. She randomly samples 14 adults of *Archilochus colubris*, resulting in a sample mean of 3.35 grams and a sample standard deviation of 0.686 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 600 questions. Each question has 4 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 170 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
280	68	
890	78	
110	39	
770	77	
480	61	
360	62	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

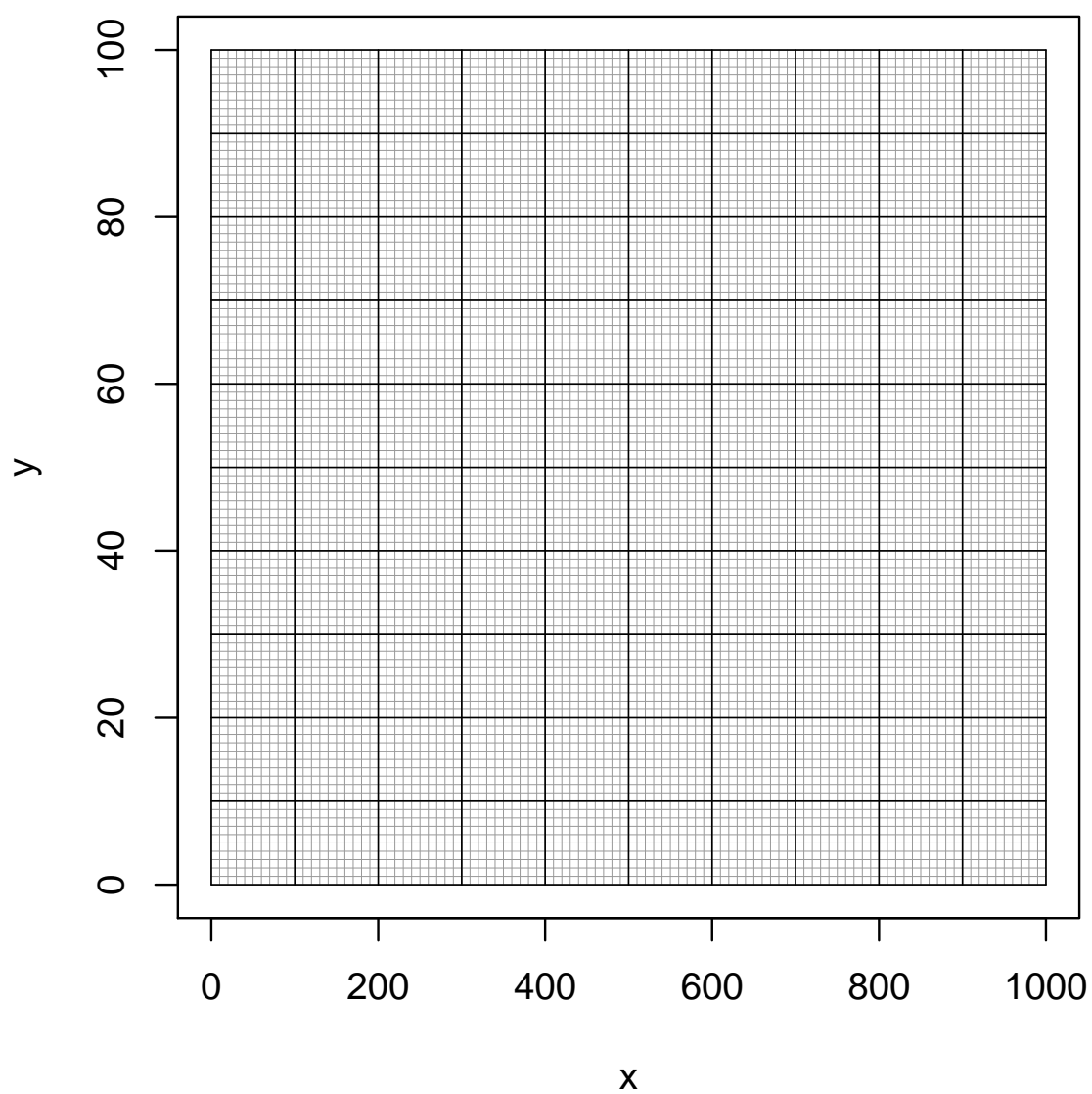
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.39$. If 75 trials occur, what is the probability of getting more than 21 but less than 36 successes?

In other words, let $X \sim \text{Bin}(n = 75, p = 0.39)$ and find $P(21 < X < 36)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 150$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.05$.

You then collect the sample:

134.7	204.4	157.5	138.7	154.9
216.2	217.3	225.1	162.3	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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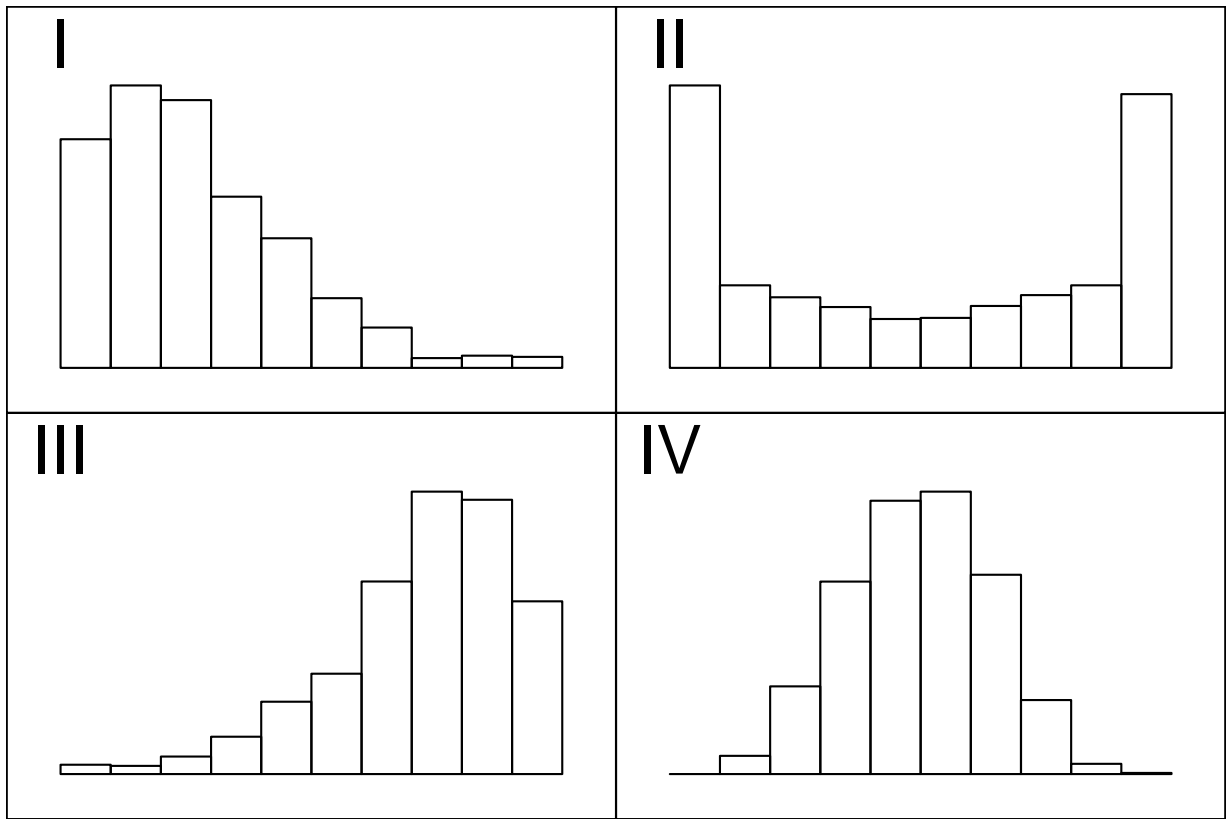
FINAL VERSION 029

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of test scores on a very difficult exam, in which most students have poor to average scores, but a few did quite well.
- (b) The distribution of lengths of newborn babies
- (c) The distribution of quiz scores on an easy quiz. Most students did very well, but a few did poorly.
- (d) The distribution of hours that students studied for an exam when about half of students studied a lot and a similar number of students studied very little.

2. (15 Points)

In a deck of strange cards, there are 759 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	green	violet	white	yellow	Total
dog	20	47	22	16	39	144
horn	14	50	18	46	10	138
kite	24	37	38	49	27	175
needle	33	35	43	23	26	160
wheel	41	36	13	21	31	142
Total	132	205	134	155	133	759

- (a) What is the probability a random card is a needle?
- (b) What is the probability a random card is either a kite or green (or both)?
- (c) What is the probability a random card is both a dog and yellow?
- (d) What is the probability a random card is a wheel given it is yellow?
- (e) What is the probability a random card is green given it is a wheel?
- (f) What is the probability a random card is gray?
- (g) Is a horn or a kite more likely to be yellow?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	78	14
<i>B</i>	114	15
<i>C</i>	113	6
<i>D</i>	143	13

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	62.88
<i>B</i>	123.8
<i>C</i>	104.4
<i>D</i>	151.6

Which specimen is the most unusually small (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 134.1 millimeters and a standard deviation of 3.1 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 131.5 and 139.6 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 179.5 grams and a standard deviation of 70 grams. A researcher plans to measure the weights of 49 of these ducks sampled randomly. What is the probability the **sample mean** will be between 170.5 and 194.5 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Porzana carolina*. She randomly samples 20 adults of *Porzana carolina*, resulting in a sample mean of 66.46 grams and a sample standard deviation of 9.57 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 600 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 323 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
26	4.5	
20	4.3	
59	7.3	
66	8.1	
21	6.7	
76	7.2	
34	6.1	
98	10	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

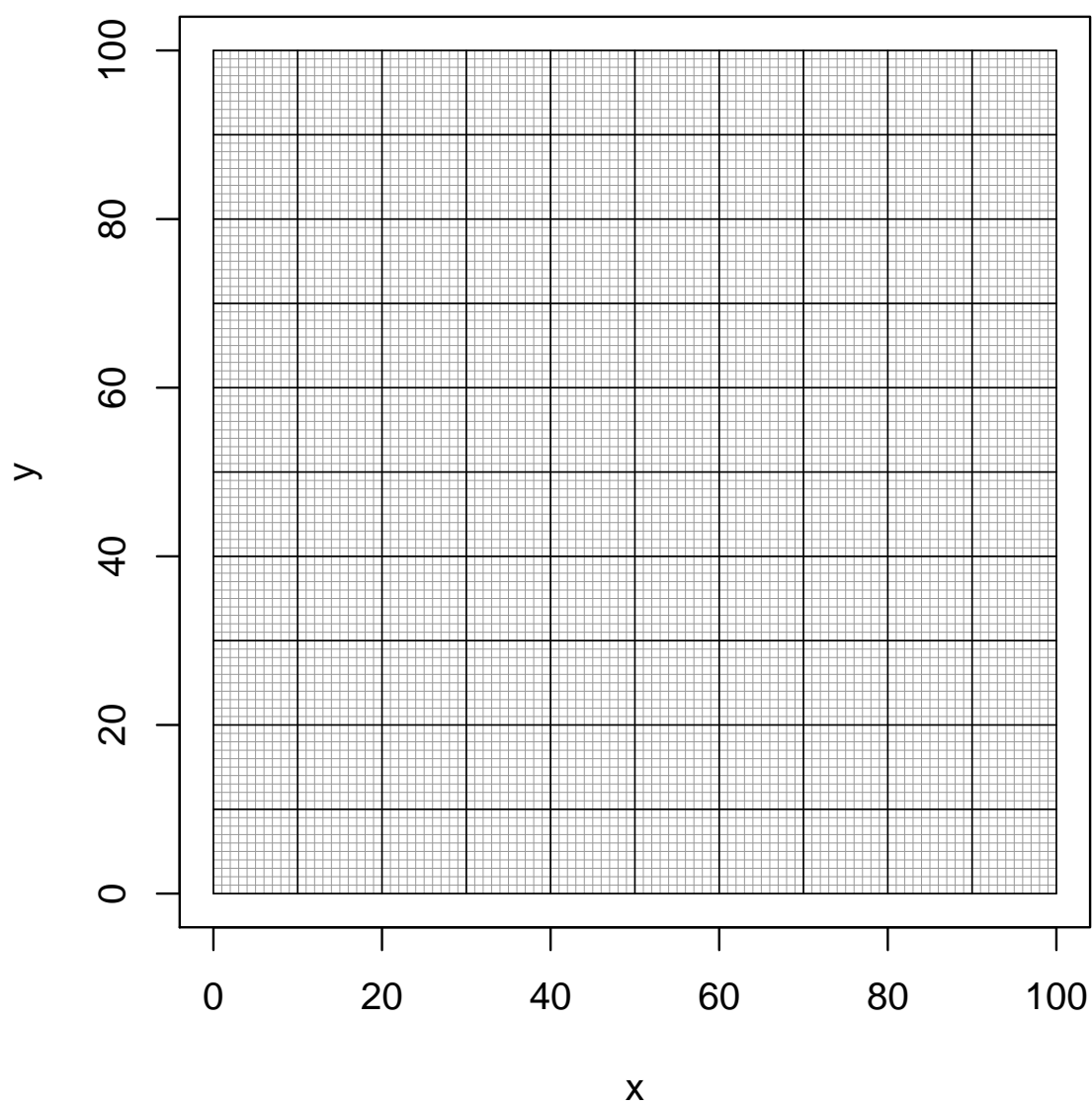
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.57$. If 183 trials occur, what is the probability of getting more than 103 but less than 108 successes?

In other words, let $X \sim \text{Bin}(n = 183, p = 0.57)$ and find $P(103 < X < 108)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 120$. You decide to run two-tail test on a sample of size $n = 8$ using a significance level $\alpha = 0.02$.

You then collect the sample:

130.8	127.7	161.8	133.7	153.8
129.3	146.7	111		

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?

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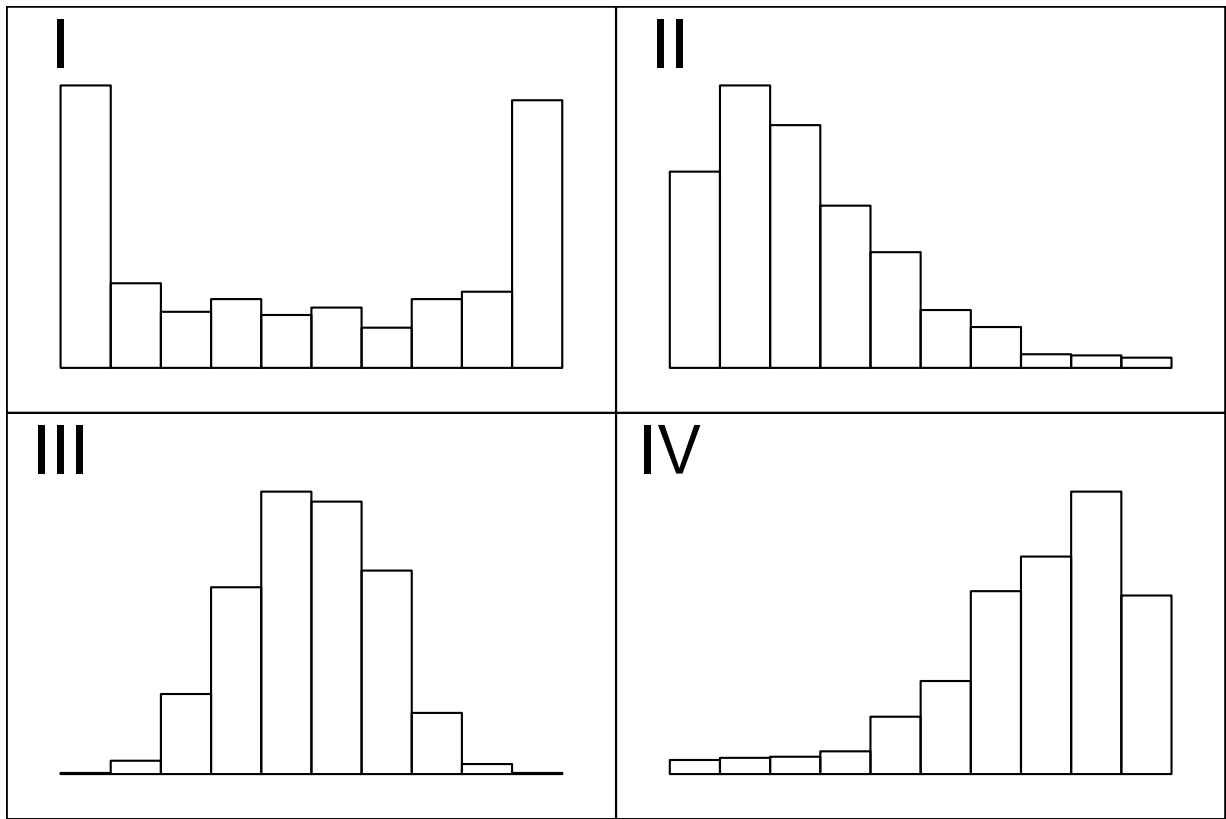
FINAL VERSION 030

MAT-181 FINAL TAKE-HOME EXAM

This exam is to be taken without discussion or correspondance with any human. Please show work!

question	available points	earned points
1	10	
2	15	
3	10	
4	10	
5	10	
6	10	
7	15	
8	20	
EC	5	
EC	5	
Total	100	

1. (10 Points)



For each description below, choose which histogram best fits (I, II, III, or IV). Each histogram should be used once.

- (a) The distribution of annual income for NBA basketball players where only a few are high-paid superstars.
- (b) The distribution of heights of adult women
- (c) The distribution of hours spent per week reading by adults. In this distribution, many people do not read much, and a similar number of people read a lot.
- (d) The distribution of ages at a skilled nursing facility, where most of the patients are elderly but a few are quite young.

2. (15 Points)

In a deck of strange cards, there are 462 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	indigo	orange	teal	Total
gem	23	39	41	12	115
kite	14	15	31	16	76
mop	25	46	19	48	138
quilt	37	17	29	50	133
Total	99	117	120	126	462

- (a) Is a kite or a quilt more likely to be teal?
- (b) What is the probability a random card is a quilt?
- (c) What is the probability a random card is teal given it is a mop?
- (d) What is the probability a random card is teal?
- (e) What is the probability a random card is both a quilt and orange?
- (f) What is the probability a random card is a kite given it is black?
- (g) What is the probability a random card is either a kite or orange (or both)?

3. (10 points)

A farm produces 4 types of fruit: *A*, *B*, *C*, and *D*. The fruits' masses follow normal distributions, with parameters dependent on the type of fruit.

Type of fruit	Mean mass (g)	Standard deviation of mass (g)
<i>A</i>	110	15
<i>B</i>	126	5
<i>C</i>	80	12
<i>D</i>	83	6

One specimen of each type is weighed. The results are shown below.

Type of fruit	Mass of specimen (g)
<i>A</i>	83
<i>B</i>	126.4
<i>C</i>	66.08
<i>D</i>	94.1

Which specimen is the most unusually far (in either direction) from average (relative to others of its type)?

4. (10 points)

A tree's leaves were found to be normally distributed with a mean of 53.3 millimeters and a standard deviation of 6.4 millimeters. If you pick a random leaf from that tree, what is the probability the length is between 44.8 and 53.7 millimeters?

5. (10 points)

A species of duck is known to have a mean weight of 178.7 grams and a standard deviation of 36 grams. A researcher plans to measure the weights of 225 of these ducks sampled randomly. What is the probability the **sample mean** will be between 175.7 and 184.7 grams?

6. (10 points)

An ornithologist wishes to characterize the average body mass of *Melospiza georgiana*. She randomly samples 32 adults of *Melospiza georgiana*, resulting in a sample mean of 13.6 grams and a sample standard deviation of 1.14 grams. Determine a 95% confidence interval of the true population mean.

7. (15 points)

A student is taking a multiple choice test with 500 questions. Each question has 2 choices. You want to detect whether the student does significantly better than random guessing, so you decide to run a hypothesis test with a significance level of 0.05.

Then, the student takes the test and gets 268 questions correct.

(a) What kind of hypothesis test is appropriate?

(b) State the hypotheses.

(c) Determine the test statistic (z or t), draw a sketch, and determine the p -value.

(d) Decide whether we reject or retain the null hypothesis.

(e) Did the student do significantly better than random guessing?

8. (20 points) [Note: this question uses 2 pages.]

You have collected the following data:

x	y	xy
62	2.2	
46	3.1	
73	3.4	
85	3.7	
65	4.8	
99	4.4	
71	6.5	
$\sum x =$	$\sum y =$	$\sum xy =$
$\bar{x} =$	$\bar{y} =$	
$s_x =$	$s_y =$	

(a) Complete the table.

(b) Calculate the correlation coefficient (r) using the formula below.

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

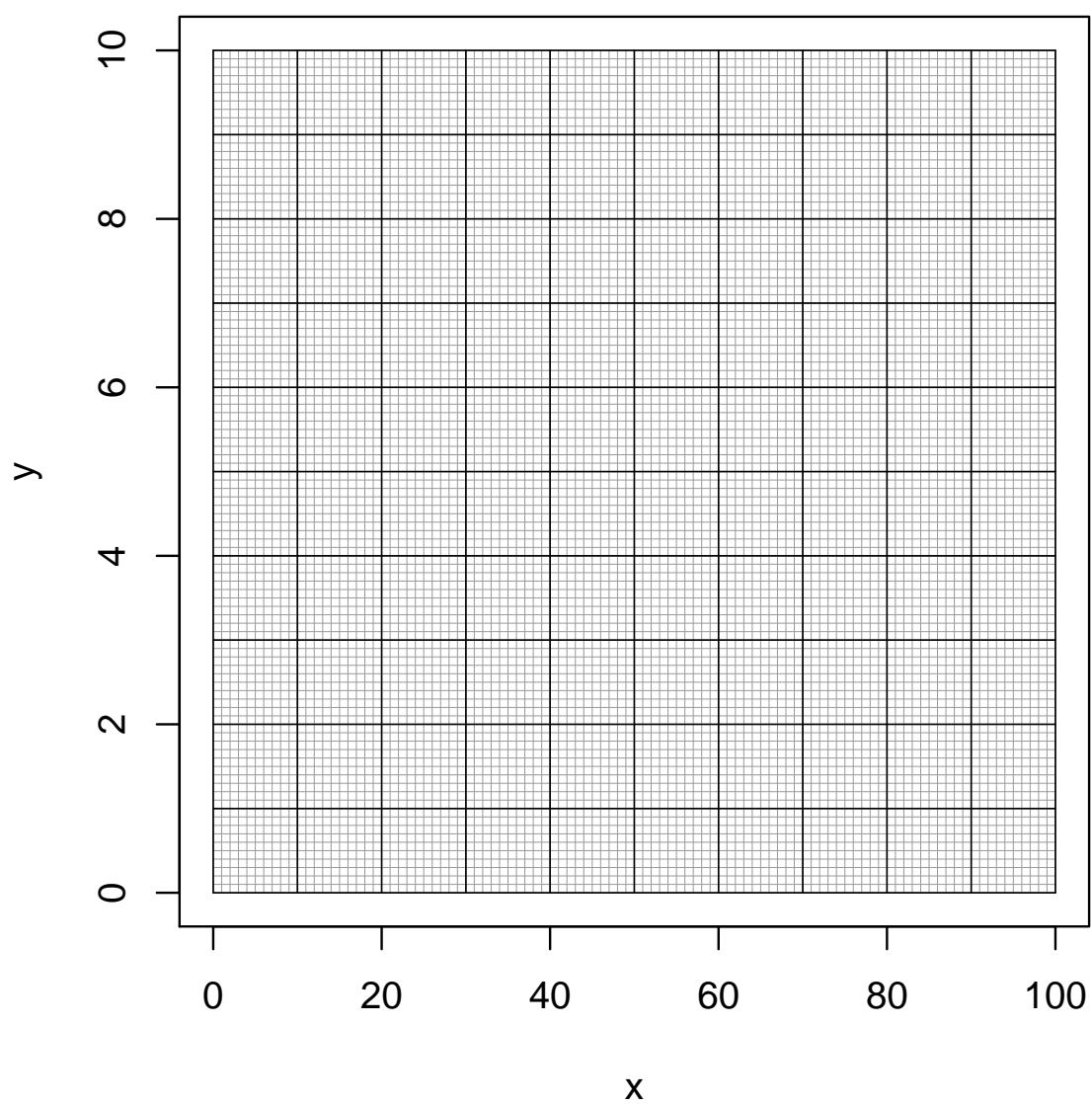
(c) The least-squares regression line will be represented as $y = a + bx$. Determine the parameters (b and a) using the formulas below.

$$b = r \frac{s_y}{s_x}$$

$$a = \bar{y} - b\bar{x}$$

(d) Write the equation of the regression line (using the calculated values of a and b .)

(e) Please plot the data and a corresponding regression line.



9. (Extra credit: 5 points)

Let each trial have a chance of success $p = 0.92$. If 238 trials occur, what is the probability of getting at least 212 but less than 225 successes?

In other words, let $X \sim \text{Bin}(n = 238, p = 0.92)$ and find $P(212 \leq X < 225)$.

Use a normal approximation along with the continuity correction.

10. (Extra credit: 5 points)

A null hypothesis claims a population has a mean $\mu = 150$. You decide to run two-tail test on a sample of size $n = 9$ using a significance level $\alpha = 0.05$.

You then collect the sample:

224.8	167.6	122	201.3	171.3
186.1	183.4	146.1	156.6	

- (a) Determine the p -value.
- (b) Do you reject the null hypothesis?