

# 143 Exam #1 Review Solutions

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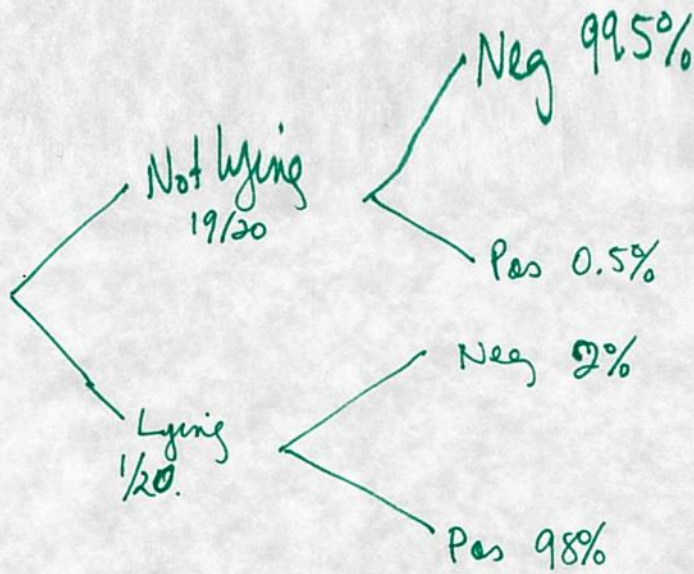
- #1 see attached table

2. 4% of the population is at or below the given value

3. 99.7%      4. 25<sup>th</sup> percentile

5. Classical is based on equally likely outcomes in the sample space  
 experimental probabilities are the result of observing a fixed # of events

6.



$$P(\text{Lying} | \text{Pos}) = \frac{P(\text{Lying} \ \& \ \text{Pos})}{P(\text{Pos})} = \frac{\frac{1}{20} \cdot 0.98}{\frac{1}{20} \cdot 0.98 + \frac{19}{20} (0.005)}$$

add up all cases that result  
 in a positive test

$$= 0.9116279$$

or about 91%.

7.  $n=50, p=0.03$

a.  $X=0$        $\binom{50}{0} (0.03)^0 (0.97)^{50} = \text{binompdf}(50, 0.03, 0) = 0.218065\dots$   
 21.8%

b.  $X=1$        $P(X \leq 1)$   
 $= P(X=0) + P(X=1) = 21.8\% + \binom{50}{1} (0.03)^1 (0.97)^{49} =$   
 $\text{binomcdf}(50, 0.03, 1) = .5552\dots$

55.5%

$\text{binomcdf}(50, 0.03, 4)$

MT 143, Exam #1 Review, Spring 2020

Major topics:

- Definitions
- Sampling Methods
- Frequency Distributions
- Making and Interpreting Graphs
- Calculating mean, median and mode, standard deviation, 5-number summary, percentiles, z-score
- Counting methods
- Probability rules
- Mean/expected value and standard deviation of discrete distributions
- Binomial probability distribution

Sample problems.

1. Classify the following variables:

(#)  
(name)

Variable	Categorical	Quantitative	Discrete	Continuous	Nominal	Ordinal	Interval	Ratio
Test Grade (Letter)	✓					✓		
Continent	✓				✓			
Month	✓	✓	✓			✓	✓	
Volume (Sound)		✓		✓			✓	
Cost (\$)		✓		✓				✓
Vegetable	✓				✓	✓		
Goal	✓				✓			
Altitude		✓		✓				✓
Growth Rate		✓		✓				✓
Sexual Orientation	✓				✓			
Year of Birth		✓	✓				✓	

2. What does it mean if we say a value represents the 4<sup>th</sup> percentile?
3. With symmetric/bell-shaped distributions, approximately what percent of the observations are within three standard deviations of the mean?
4. Expressed in percentiles, what does the first quartile represent?
5. Explain the difference between a classical (theoretical) probability and an experimental (observational) probability.
6. A particular model of lie detector test has a 98% probability of correctly detecting someone who is lying, and 99.5% probability of correctly detecting someone who is not lying. A human police officer interviews suspects using the lie detector, hoping to catch the 1 of the 20 suspects worth investigating further who they believe to be lying. If someone tests positively on the lie detector

**Stem-and-leaf of Problem9 N = 60**

```

5  5  05668
15 6  3345567899
27 7  122224566899
(18) 8  011123344556777899
15 9  00112456689
4  10 0159
    
```

Leaf Unit = 1

**Stem-and-leaf of Problem9 N = 60**

```

1  5  0
5  5  5668
8  6  334
15 6  5567899
21 7  122224
27 7  566899
(9) 8  011123344
24 8  556777899
15 9  001124
9  9  56689
4  10 01
2  10 59
    
```

Leaf Unit = 1

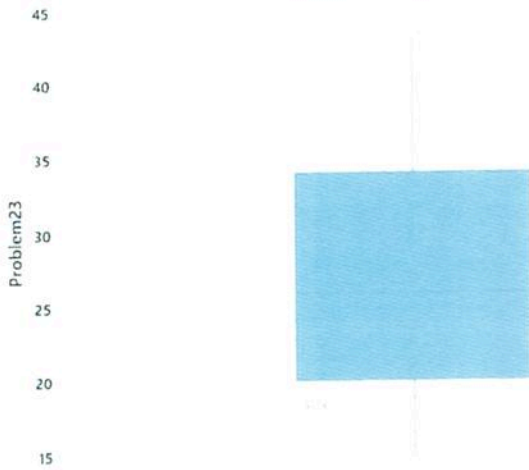
**Statistics**

Variable	Total Count	Mean	StDev	Variance	Minimum	Q1	Median	Q3	Maximum	Range	IQR
Problem9	60	79.98	13.44	180.66	50.00	69.50	81.00	89.75	109.00	59.00	20.25

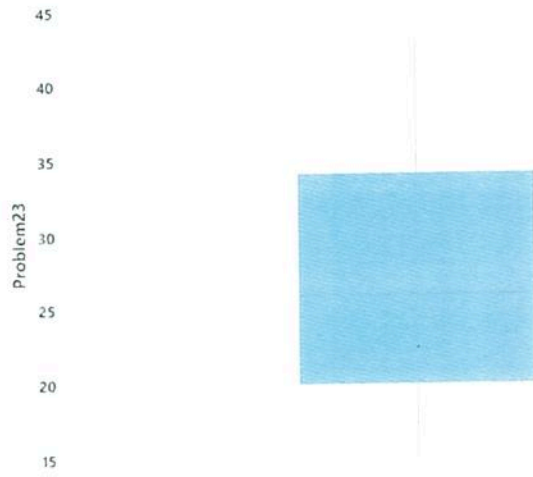
  

Variable	Mode	N for Mode
Problem9	72	4

Boxplot of Problem23



Boxplot of Problem23



**Statistics**

Variable	Total				Minimum	Q1	Median	Q3	Maximum	Range
	Count	Mean	StDev	Variance						
Problem23	15	26.87	9.10	82.84	15.00	20.00	26.00	34.00	43.00	28.00

Variable	IQR	N for	
		Mode	Mode
Problem23	14.00	15, 23, 26, 43	2

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(2)

9. see minitab data attached

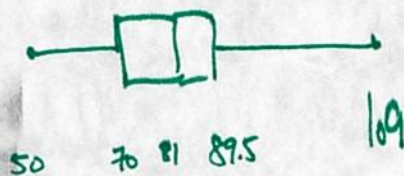
a. → 2 versions by 10's, by 5's

b.  $\bar{x} = 79.98$  median = 81 mode = 72

c.  $S = 13.44$  range =  $109 - 50 = 59$

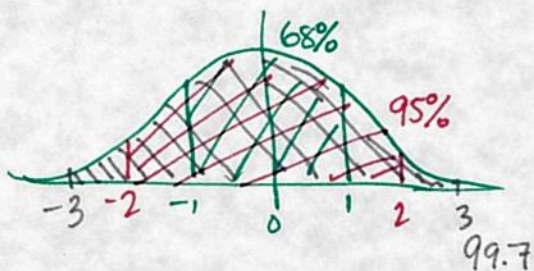
d. Min = 50,  $Q_1 = 70$ ,  $Q_2 = \text{med} = 81$ ,  $Q_3 = 89.5$ , max = 109

e. see minitab graph attached.



f.  $\frac{17}{60} \rightarrow \frac{20}{60}$   
 28th + 33rd

10.



11. a.  $\frac{88 - 72}{5} = 3.2$

b. 99.9? roughly since it is well above 3

c.  $67 \sim -1\sigma$  and  $82 \sim +2\sigma$   $\frac{68 + 82}{2} = 81.5$

12. a. roughly symmetry or slightly right skewed

b. right skewed

c. none

d. roughly uniform

13. a.  $\frac{6}{100}$  b.  $\frac{42}{100}$  c.  $1 - \frac{42}{100} = \frac{58}{100}$  d.  $\frac{2}{100} \cdot \frac{8}{99} \cdot \frac{1}{98} = 1.649 \times 10^{-5}$

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15b.  $\binom{42}{6} = 5,245,786$

c.  $10PC = 10 \cdot 9 \cdot 8 = 720$

d.  $\frac{12!}{2!2!} = 119,750,400$

16. a.  $\left(\frac{1}{2}\right)^9 = \frac{1}{512} = 0.00195$

b.  $\frac{13 \cdot \binom{4}{3} \binom{48}{2}}{\binom{52}{5}} = 0.022569 \approx 2.3\%$

17a. 126    b. 210    c. 792    d. 1

18.

	1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8	9
2	3	4	5	6	7	8	9	10
3	4	5	6	7	8	9	10	11
4	5	6	7	8	9	10	11	12
5	6	7	8	9	10	11	12	13
6	7	8	9	10	11	12	13	14
7	8	9	10	11	12	13	14	15
8	9	10	11	12	13	14	15	16

$\frac{3}{64}$

19.  $0(0.07) + 1(0.13) + 2(0.18) + 3(0.30) + 4(0.22) + 5(0.08) + 6(0.02)$   
 $= 2.79$

20.

x	490	90	40	-10
P(x)	$\frac{1}{450}$	$\frac{1}{450}$	$\frac{2}{450}$	$\frac{446}{450}$

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21.  $n=10, p = \frac{2}{3}$

a.  $\binom{10}{8} \left(\frac{2}{3}\right)^8 \left(\frac{1}{3}\right)^2 = \text{binompdf}(10, \frac{2}{3}, 8) = 0.19509\dots$   
19.5%

b.  $P(x \leq 8) = \text{binomcdf}(10, \frac{2}{3}, 8) = 0.89595 \approx 89.6\%$

c.  $\mu = E(x) = np = 10\left(\frac{2}{3}\right) = 6.67$

22. a.  $\frac{1640 - 1498}{199} = 0.7135\dots$

b.  $\frac{28 - 21}{5.2} = 1.346\dots$

$\frac{1910 - 1498}{199} = 2.07\dots$

Barbara did better

23. See attached minitab work

a.  $26.87 = \text{mean } \bar{x}$ , median = 26, mode = none

b. St. dev = 9.10 range = 28

c. min = 15,  $Q_1 = 20$ , Med = 26,  $Q_3 = 34$ , Max = 43