

Express your answers neatly. Show all relevant work for partial credit. Give units and correct significant figures.

Determine whether the given value is a statistic or a parameter.

- 1. A sample of Medtronic's rechargeable implanted spine stimulator batteries lasted an average (mean) of nine years. stat.
- 2. In studying the loggerhead turtle on Anna Maria Island, FL, scientists observe the average (mean) number of hatchlings in all 253 nests. parameter

1.5 each

Determine whether the given values are from a discrete or a continuous data set.

- 3. The number of hatchlings from a sample of 45 bluebirds is 135. discrete
- 4. A sample of Dall sheep is measured to have an average (mean) horn length of 35.7 inches. continuous

Use the following sample data for the following seven questions. A study of physical fitness tests for 12 randomly selected Pre-Medical students measured their exercise capacity (in minutes). The following data resulted:

34	23	33	30	42	36	$\frac{42-18}{5} = \frac{24}{5} \approx \frac{25}{5} = 5$
32	41	31	31	37	18	

- 5. Find the mean, the median, and the mode for the student's exercise capacity (calculator!).

mean: $32.3^{min} = \bar{x}$, median: 32.5^{min} , mode: 31^{min}

2 each

- 6. Using five classes, construct a frequency distribution of the student's exercise capacity.

Class	Frequency
18-23	1
23-28	1
28-33	4
33-38	4
38-43	2

2

- 7. Find the sample standard deviation and variance of the student's exercise capacity (calculator).

standard deviation: $S = 6.8^{min}$, variance: $S^2 = 46.24^{(min)^2}$

4

- 8. Identify the five number summary for the student's exercise capacity.

$min = 18, Q_1 = 30.5, Q_2 = 32.5, Q_3 = 36.5, max = 42$ (all minutes!) 4

- 9. Use the 1.5 IQR Rule to identify outliers, if any. Show your work.

$IQR = 36.5 - 30.5 = 6, 1.5 IQR = 9$
 low fence = $Q_1 - 1.5 IQR = 30.5 - 9 = 21.5$
 upper fence = $Q_3 + 1.5 IQR = 36.5 + 9 = 45.5$
 $18 < 21.5$ are outliers 4

- 10. Find the percentile corresponding to 36 minutes.

There are 8 values below 36 $\frac{8}{12} * 100 = 66.6 \approx 67^{th}$ percentile

$P_{67} = 36$ 2

- 11. Find the data value corresponding to the 26th percentile (P_{26}).

$L = \frac{26}{100} * 12 = 3.12 \nearrow 4$

$P_{26} = 31$ 2

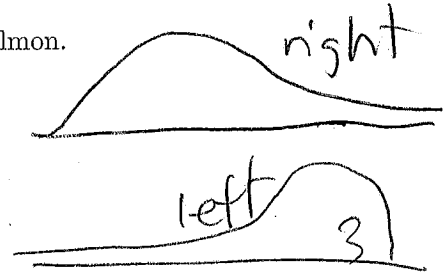
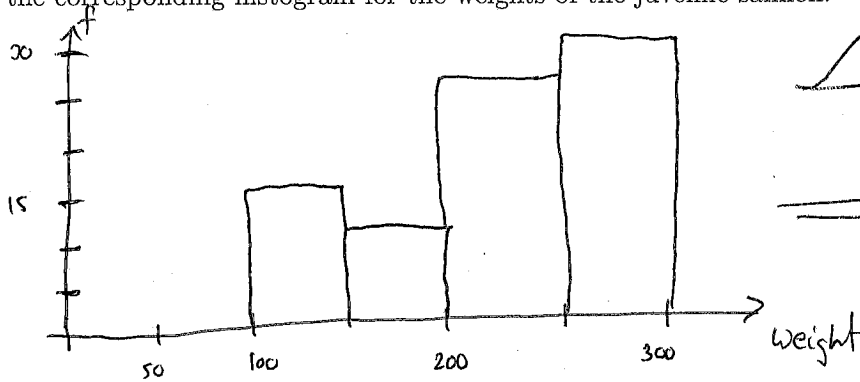
30

B

Use the frequency distribution to answer the next 5 questions. A sample of 80 juvenile salmon is grouped into the resulting frequency distribution based on their weights.

Weight (in grams)	Frequency
100-150	15
150-200	10
200-250	25
250-300	30

12. Construct the corresponding histogram for the weights of the juvenile salmon.



13. Determine the approximate sample mean weight of the juvenile salmon summarized in the frequency distribution.

$$\bar{x} \approx \frac{125 * 15 + 175 * 10 + 225 * 25 + 275 * 30}{80} = \frac{17,500}{80} = 218.75g \quad 3$$

14. What is the percent relative frequency of juvenile salmon between 200 and 250 grams?

$$\frac{25}{80} * 100\% = 31.25\%$$

218.8 g 2

15. What is the cumulative frequency of salmon weighing less than 250 grams?

50 2

16. The distribution of the histogram for the weights of juvenile salmon appears

- (a) normal (bell-shaped)
- (b) uniform (even)
- (c) skewed left (negatively)
- (d) skewed right (positively)

2

Use the following data for the next four questions. Dental researchers found that a sample of females scored the following on the Dental Hygiene Fear Survey:

Total Fear Score Mean	27.5
Standard Deviation	10.9

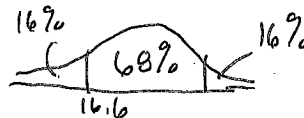
Assume fear scores follow a bell-shaped distribution.

17. Using the Empirical Rule, what is the approximate percentage of females with a total fear score between 16.6 and 38.4?

$$\bar{x} \pm S = 27.5 \pm 10.9 \rightarrow (16.6, 38.4)$$

≈ 68% 2

18. What percentage score below 16.6?



≈ 16% 2

19. Convert a total fear score of 10 to a z-score.

$$z = \frac{x - \mu}{\sigma} = \frac{10 - 27.5}{10.9} =$$

-1.61 2

For the following four problems, determine which of the four levels of measurement is most appropriate: nominal, ordinal, interval, ratio.

- 20. Ornithologists classify hummingbirds in the United States using 17 different species: Allen, Anna, Berryline, Black-chinned, etc. What type of data is collected?
nominal
- 21. The income range of attendees at a research conference is gathered as upper, middle, and low levels. What type of data is collected?
ordinal
- 22. Biologists measure the water temperature of the Merrimack River in New Hampshire. What type of data is collected?
interval
- 23. Doctors measure the weights (in pounds) of preterm babies. What type of data is collected?
ratio

Determine whether the given description corresponds to an observational study or an experiment.

- 24. In a study of cold symptoms, the body temperatures of study participants were taken.
observational
- 25. Children with attention deficit hyperactivity disorder are randomly divided into four treatment groups (the Tomatis Method, the Dore Method, the Brain Gym, and a control group) to compare differences in focus and concentration.
experiment

Determine the type of sampling used: systematic, convenience, stratified, or cluster.

- 26. To conduct a study of Johnson & Johnson shareholder attitudes, a list of shareholder zipcodes is compiled. All shareholders from 20 different zipcodes are surveyed.
cluster
- 27. To obtain a sample of pregnant women, a researcher contacts her son's preschool teacher of a list of names.
convenience
- 28. Biologists divide the region where Red foxes are found into the Nearctic, Palearctic, Oriental, Ethiopian, and the Australian region. They plan to follow 100 female foxes from each region to find the average (mean) number of their offspring.
stratified
- 29. A county water quality control officer obtains a list of all residential addresses in the county and constructs a sample of homes to monitor by selecting every 200th home on the list.
systematic

1.5
each

The following questions relate to random samples and simple random samples.

- 30. To monitor levels of the giardia parasite in the Rio Grande, aquatic biologists collect test tube samples at various locations determined by a computer randomization program (locations were randomly selected from a long list of possible sampling locations). Does this sampling plan result in a random sample? Simple random sample?
SRS is random sample
- 31. To assess the variation in measurement (in cubic centimeters) of pre-filled syringes containing experimental cervical cancer vaccine, manufacturers select every 200th syringe beginning at a random moment. Does this sampling plan result in a random sample? Simple random sample?
random sample only

Use the following sample data for the following four questions. In an experiment to study the effect of Donepezil on individuals at risk of developing Alzheimer's disease, the following was collected:

	Taking Donepezil	Taking Placebo
Progressed to Alzheimer's	19	38
Did not progress to Alzheimer's	240	215

57
455
n = 512

32. If one of the individuals is randomly selected, find the probability of getting an individual who progressed to Alzheimer's.

$$\frac{57}{512} \approx$$

.111 3

33. If one of the individuals is randomly selected, find the probability of getting an individual who did not progress to Alzheimer's or who took a placebo.

$$\frac{240 + 215 + 38}{512} \approx \frac{493}{512} \approx$$

.963 3

34. If two different individuals are randomly selected, find the probability that both progressed to Alzheimer's (sample without replacement).

$$\frac{57}{512} * \frac{56}{511} = \frac{3192}{261632} \approx$$

.0122 3

35. If one individual who took Donepezil is selected, what is the probability they progressed to Alzheimer's.

$$\frac{19}{259} \approx$$

.0734 3

In the next two problems we are going to make 6 digit ID numbers using the digits 0 through 9

36. How many 6 digit ID numbers are possible if repeated digits are allowed (each digit can be 0 through 9)?

$$\frac{10}{10} \frac{10}{10} \frac{10}{10} \frac{10}{10} \frac{10}{10} \frac{10}{10} = 10^6$$

$10^6 = 1,000,000$ 2

37. How many 6 digit ID numbers are possible if repeated digits are not allowed (once a digit is used in the ID number, it cannot be used again)?

$$\frac{10}{9} \frac{8}{7} \frac{6}{5} = 10P_6 =$$

151,200 2

The next four problems have to do with a sequence of 10 coins tosses

38. How many sequences of heads and tails are possible in 10 coin tosses?

$$2^{10} = 1024$$

39. How many sequences of 10 coin tosses consist of 3 heads and 7 tails?

choose slots for 3 heads $10C_3 =$

$$10C_3 = 120$$

40. What is the probability of tossing 3 heads and 7 tails in 10 coin tosses?

$$\frac{120}{1024} \approx$$

.117 2

41. What is the probability that at least one of the 10 tosses is heads?

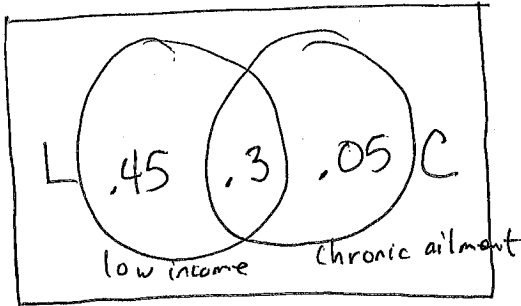
$$P(\text{at least one}) = (1 - P(\text{none})) = (1 - P(\text{all tails})) = 1 - \left(\frac{1}{2}\right)^{10} = 1 - \frac{1}{2^{10}} = 1 - \frac{1}{1024} = \frac{1023}{1024}$$

.999 2

For the next four problems consider the following information about Hurricane Katrina: Sociologists profiling the refugees from Hurricane Katrina over the age of sixty in the New Orleans Superdome found the following:

- 75% had annual incomes of \$8,000 or less (low income)
- 35% suffered from a chronic ailment such as diabetes and/or asthma
- 30% had low income and a chronic ailment

42. Draw a complete Venn diagram of these results.



2

43. Are low income and chronic ailment independent? JUSTIFY.

$P(C \cap L) = .3$, but $P(L) * P(C) = .75 * .35 = .2625$
 Since $P(C \cap L) \neq P(C) * P(L)$, L & C are dependent 2

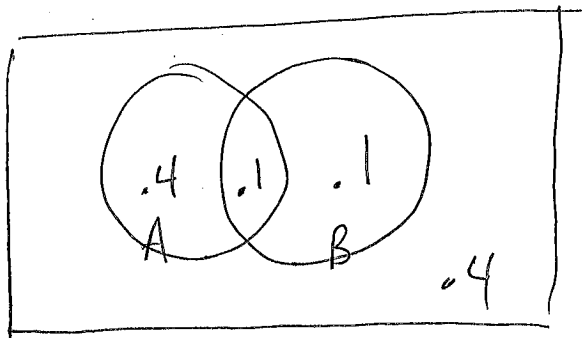
44. What is the probability that a low income refugee has a chronic ailment?

$P(C|L) = \frac{.3}{.75} = .4$
 (note $P(C|L) \neq P(C)$)

$P(C|L) = .4$ 2

If you still have time ... kind of a tough puzzle problem:

45. $P(A) = .5, P(B|A) = .2, P(A|B) = .5$. What is $P(\bar{A} \cap \bar{B})$?



$P(\bar{A} \cap \bar{B}) = .4$ 4

$P(A|A) = \frac{P(A \cap B)}{P(A)}$
 $.2 = \frac{P(A \cap B)}{.5}$
 $P(A \cap B) = .2 * .5 = .1$

$P(A|B) = \frac{P(A \cap B)}{P(B)}$
 $.5 = \frac{.1}{P(B)}$
 $\frac{1}{.5} = \frac{P(B)}{.1}$
 $P(B) = \frac{.1}{.5} = .2$