(8 points)

3. In each column, circle the appropriate characteristic for the data described.

(a) A geologist studies the **density** (grams per cubic cm) of different volcanic rocks.	Qualitative Quantitative	Discrete Continuous	Nominal Ordinal	Interval Ratio
(b) A department store records the **number** of customers that bought "pet rocks" in November	Qualitative Quantitative	Discrete Continuous	Nominal Ordinal	Interval Ratio
(c) An insurance company counts the **number** of accident claims that involve rocks hitting car windows.	Qualitative Quantitative	Discrete Continuous	Nominal Ordinal	Interval Ratio
(d) An agent prepares a list with the **names** of 37 rock bands in the Sacramento area.	Qualitative Quantitative	Discrete Continuous	Nominal Ordinal	Interval Ratio
(e) An earthquake investigator measures the **ages** of rocks (how many years since each rock was formed).	Qualitative Quantitative	Discrete Continuous	Nominal Ordinal	Interval Ratio
(f) Volcano watchers measure the **temperatures** of rocks in degrees Celsius to predict erruptions.	Qualitative Quantitative	Discrete Continuous	Nominal Ordinal	Interval Ratio

Could be discrete if only whole years are counted.

(8 points: 8 minutes)

1. **For the data in Column A, circle the appropriate chacteristics in Column B and Column D. If the characteristic you circled in in Column B is "Quantitative," than circle the appropriate characteristic in Column C.**

Column A	Column B	Column C	Column D
Scientists measure the temperatures of Alaskan sled dogs in °F.	Qualitative Quantitative	Continuous Discrete	Nominal Ordinal Interval Ratio
The names of Alaskan sled dogs that live longer than 7 years.	Qualitative Quantitative	~~Continuous~~ ~~Discrete~~	Nominal Ordinal Interval Ratio
The number of times that "Fred," an Alaskan sled dog, turns all the way around before lying down to sleep.	Qualitative Quantitative	Continuous Discrete	Nominal Ordinal Interval Ratio
The lengths of the hairs on the tails of Alaskan sled dogs.	Qualitative Quantitative	Continuous Discrete	Nominal Ordinal Interval Ratio

(7 points: 10 minutes)

3. **For each situation below, select the appropriate statistical term from the list provided and write it in the blank next to the description or situation. Choose the term that is best connected to the underlined text in the description or situation.**

Terms:		
	1. randomization	**5. placebo**
	2. replication	**6. block**
	3. confounding	**7. experimental unit**
	4. blinding	**8. treatment**

A. BLOCK **Each person included in the study belonged to a group of other people in the study who had similar physical attributes and similar lifestyles.**

B. RANDOMIZATION **A scientist prepares experimental material in groups of similar units. Within each group, each experimental unit is assigned to a treatment so that all possible pairings of treatments and units are equally likely to occur.**

C. Experimental Unit **A flower-growing company tests 100 rose bushes, each in its own pot. Each pot (or each bush) is treated with one of two insect poisons, where the poison is chosen at random.**

D. Placebo **A veterinarian (animal doctor) works with 30 horse owners to compare the effectiveness of vitamin supplements in a horse's diet. Ten horse owners feed the horses supplement A. Ten feed with supplement B. And, ten use supplement C, which neither harms nor helps horses.**

E. Confounding **An experiment was done to see how children with asthma react to ozone, a pollutant that irritates lungs. During the study, the children had more asthma symptoms when ozone was high and fewer symptoms when ozone was low. But, ozone is often high on Sunday and low on Monday, so a reviewer wonders if the children's response might be due to the day of week rather than due to ozone.**

F. Replication **A political consultant tests three different TV adds for possible use in the campaign. One add is tested in ~~Sab~~ San Francisco, another in Fresno, and another in Orange County. An important feature is lacking in this experiment.**

G. Blinding **Ten cars (with their drivers) will be used to test two gasolines for mileage (miles per gallon). Technicians will fill the cars so so the driver will not know if gasoline "A" or "B" is being used.**

H. Treatment **Ten cars (with their drivers) will be used to test two gasolines for mileage (miles per gallon). Technicians will fill the cars so so the driver will not know if gasoline "A" or "B" is being used.**

(4 points: 5 minutes)

2. **A real estate developer is interested in the values of homes in California. In particular, he/she wants to know whether the median value of all homes in California is now more than $200,000. To explore this question, 500 in California homes are selected at random and their current values are determined. The median value of the 500 homes is $212,800, which is more than $200,000.**

Use the information in the "story" to answer the following:

(a) What is the population of interest?

The values of homes (all homes) in CA

(c) What statistic was used? (numerical characteristic of sample)

The ~~m~~ median value of 500 homes sampled.

(d) What parameter was the parameter of interest? (numerical characteristic of popul.)

The median value of all homes in CA

(d) Was a census or a sample used in the work?

A sample

(e) How do you know whether a census or a sample was used?

Only 500 home values were considered.
A census would examine all home values.

(6 points, 12 minutes)

5. **Identify each situation below as RANDOM, STRATIFIED, SYSTEMMATIC, CLUSTER, or CONVENIENCE sampling.**

   (a) A chain of pizza restaurants wants to know the preferences of their customers for different kinds of pizza. The chain arranges for a study to select 200 households at random. At each household, the preferences of all residents are determined.

   Cluster

   (b) A chain of pizza restaurants (stores) wants to know whether customer preferences are the same in urban, suburban, and rural areas. They select 10 urban stores at random, 8 suburban stores at random, and 6 rural stores at random. The sales of each type of pizza at the selected stores are compared.

   Stratified

   (c) The owner of a music store believes his customers eat lots of pizza. Therefore, he goes to local pizza restaurants and asks the restaurant's customers what kinds of CD's they like to buy. Some of the people are glad to tell him their music preferences but others tell him to go away.

   Convenience

   (d) A factory makes frozen pizzas for grocery stores. The quality control unit at the factory tests every 500th pizza to ensure that the product meets the required standards for quality.

   Systematic

   (e) The federal government wants to know how long workers at pizza restaurants keep their jobs. By using data from income tax records, the government prepares a sample of 2000 pizza workers. Every pizza worker has an equal chance of being in the sample. The length of time each worker worked at their job is discovered.

   Random

   (Cluster is also acceptable, here)

1. **Identify each of the following "sampling" situations as RANDOM, STRATIFIED, SYSTEMMATIC, CLUSTER, or CONVENIENCE sampling.**

A marketing company conducts a survey of product preferences. To make sure that their results are useful to many customers, they select random samples of 500 individuals from each of 10 age groups.

(a) Stratified

A quality control manager needs to report on product quality, so he directs the testing technicians to get 100 items out of the stack of boxes on the shipping platform and test them.

(b) Convenience

A supervisor monitors the accuracy of every 50th telephone call handled by customer service agents.

(c) Systematic

A chain of pizza restaurants decides to examine customer preferences. A list of tables at all of the chain's restaurants is prepared, and tables are selected at random. All customers that sit at each selected table are asked whether they like the pizza theyare eating.

(d) Cluster

The Highway Patrol wants to test the value of their new "traffic school." They select 400 people convicted of drunk driving in the last two years in a way that gives all such convicts an equal chance of being selected. Half of those selected are assigned to the old "traffic school" and half to the new "traffic school."

(e) Random

(Cluster is also possible, but unlikely)

(6 points, 6 minutes)

1. **Use the data below to determine the frequencies, relative frequencies, cumulative frequencies, and cumulative relative frequencies for the frequency table.**

Data
~~3587.4~~
~~2335.4~~
~~1735.0~~
~~6091.5~~
~~4184.3~~
~~3423.2~~
~~2833.5~~
~~3522.3~~
~~5052.0~~
~~7310.6~~
~~5885.3~~
~~3311.1~~

Class Limits Upper	Class Limits Lower	Tally	Frequency	Relative Frequency	Cumulative Frequency	Relative Cumulative Frequency
1000	2000	II	2	2/12	2	2/12
3000	4000	~~IIII~~ I	6	6/12	8	8/12
5000	6000	III	3	3/12	11	11/12
7000	8000	I	1	1/12	12	12/12

Boundary

2500

4500

6500

N = 12

(8 points)

2. **Complete the columns in the "Frequency Distribution" table using the data values given below, and determine the class width.**

Frequency Distribution

Class Limits Lower	Class Limits Upper	Tally	Frequency	Relative Frequency	Cumulative Frequency	Cumulative Relative Frequency
1.4	**1.6**	II	2	2/13	2	2/13
1.7	**1.9**	I	1	1/13	3	3/13
2.0	**2.2**	卌 III	8	8/13	11	11/13
2.3	**2.5**	II	2	2/13	13	13/13

N = 13

Class Midpoint	Class Boundary
1.5	
	1.65
1.8	
	1.95
2.1	
	2.25
2.4	

Data:	~~2.16~~	~~2.33~~	~~2.43~~	~~1.84~~	~~2.14~~	~~2.24~~
	~~1.98~~	~~2.05~~	~~1.64~~	~~2.19~~	~~2.08~~	~~2.22~~
	~~1.56~~					

Class width = 0.3

3. **For the data in this problem, calculate the following sample statistics: RANGE, STANDARD DEVIATION ,and VARIANCE. You may use your calculators or do the calculations "by hand".**

Data:
11
8
16
20
6
8

Range = 14 $= max - min = 20 - 6 = 14$

$S =$ **Standard deviation =** 5.43 (use calculator's statistical functions)

$S^2 =$ **Variance =** 29.5 $= (5.43)^2$

(2 points)

4. **Without calculating it directly, estimate the standard deviation for the data in problem 3 above. (Show how you did the estimation)**

Estimate of s = 3.5

Range Rule $= S \cong \frac{\text{Range}}{4}$

$\cong 14/4 = 3.5$

(14 points, 10 minutes)

3. Use the data below to determine the value of each statistic in parts (a) through (g). Write an expression for each statistic or describe how it is calculated (do NOT describe how to use the calculator).

Data
397
329
291
508
433
436

291
329
397
433
436
508

Statistic	**Expression or Description**	**Value of statistic**
(a) Mean	$\frac{\sum x}{n}$	399
(b) Median	middle value when data are put in sorted order.	N is even, so median is avg. of middle 2 $(397+433)/2 =$ 415
(c) Mode	The most frequent (common) value.	All values are unique, so there is No mode
(d) Mid-range	$\frac{Min + Max}{2}$	399.5
(e) Range	Max − Min	$508 - 291 =$ 217
(f) Standard Deviation	$\sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$	78.71
(g) Variance	$\frac{\sum(x-\bar{x})^2}{n-1}$	6194.8

(4 minutes)

7. Plant species "A" has leaves that average 8 centimeters long with a standard deviation of 0.8 centimeters. Plant species "B" has flowers with an average width of 2 centimeters with a standard deviation of 0.25 centimeters. Which of the two plants below is the most unusual? Circle (a) or (b) and show why!

(a) A plant from species "A" has leaves that are 6 centimeters long.

$x = 6$
$\mu = 8$
$\sigma = 0.8$

$$z = \frac{6-8}{0.8} = \frac{-2}{0.8} = -2.5$$

largest $|z|$, so most unusual

(b) A plant from species "B" has flowers that are 2.5 centimeters wide.

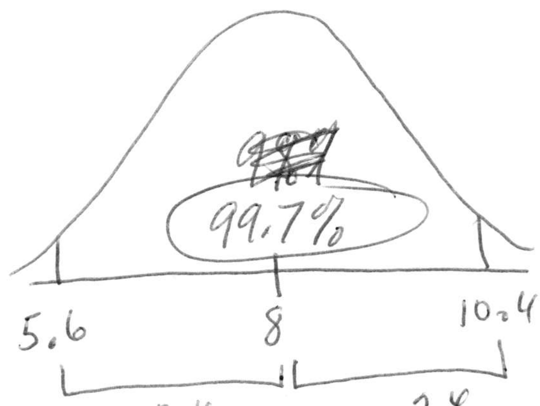
$x = 2.5$
$\mu = 2$
$\sigma = 0.25$

$$z = \frac{2.5-2}{0.25} = \frac{0.5}{0.25} = 2.0$$

(4 minutes)

8. A plant species has leaves that average 8 centimeters long with a standard deviation of 0.8 centimeters. The distribution of leaf lengths is approximately "bell-shaped". What percentage of the leaves from plants of this species should be between 5.6 cm and ~~10.6~~ 10.4 cm long? Show why!

Empirical Rule says that about 99.7% of the values in a bell-shaped distribution will be "within 3σ" of the mean.



(6 points)

5. Provide the "z-scores" for each situation.

	μ	σ	X	z
(a)	60	20	88	1.4
(b)	60	5	52	-1.6
(c)	60	4	68	2.0

$(88-60)/20 =$

(d) If the distribution is "Bell-shaped", which "X" value is the most unusual?

The most unusual value has the largest $|z|$, which is 2.0 for c

(e) Approximately what percent of the data are closer to the mean than the X value in your answer for part (d)? [Be sure to explain how you get your estimate]

in part(d), the distribution is "bell-shaped."

c had a z-score of 2, which means

$(x-\mu)$ is 2σ.

within 2σ, we should find about 95% of the values in the data according to the Empirical Rule.

(3 points)

6. For the data below, what is the percentile ($P_?$) of the value 486 ?

~~736~~	~~486~~	~~26~~	~~360~~	~~186~~	~~758~~	~~548~~

26 186 360 486 548 736 758 – sorted order.

these values are < 486

$$k = \left(\frac{\#\text{ of values} < x}{\text{total \# of values}}\right)100 = \left(\frac{3}{7}\right)100 = (0.4286)\,100 = 42.86$$

$486 = P_{42.86}$ OR P_{43}

(3 points)

7. For the data below (given in sorted order), what is the 27th percentile?
[note: There are 60 values in the dataset, five values per row]

1748	1767	1772	1777	1784
1799	1810	1837	1861	1896
1932	1945	1967	1973	1985
1990	2007	2008	2039	2060
2069	2098	2126	2147	2172
2177	2208	2210	2223	2248
2267	2272	2311	2316	2330
2331	2354	2380	2403	2423
2443	2475	2481	2492	2518
2555	2585	2596	2630	2656
2680	2706	2708	2712	2729
2740	2775	2791	2805	2821

Location of $P_{27} = L = \left(\frac{27}{100}\right)60 = \left(\frac{k}{100}\right)N$

$= 16.2$ round up to 17

at position 17, $x = 2007$.

$P_{27} = 2007$

4. The data at the bottom of the page are in seven rows of ten values and the values are sorted from smallest to largest. Use these data to answer parts (a) and (b) of this question.

(4 points, 4 minutes)

(a) What value represents to 83rd percentile, P83?

P_{83} $k = 83$ location of $P_{83} = \left(\frac{83}{100}\right)N = \left(\frac{83}{100}\right)70$

$= 58.1$ round up to 59^{th} position

$\boxed{P_{83} = 481}$

(4 points, 4 minutes)

(b) What percentile, P?, is represented by the value 222?

4 values are < 222

$k = \left(\frac{\#\text{ of values} < x}{\text{total }\#\text{ of values}}\right)100 = \left(\frac{4}{70}\right)100 = 5.7$

$\boxed{222 = P_{5.7} \text{ or } P_6}$

59^{th} position

200	210	212	220	222	222	226	228	234	240
244	252	255	259	264	271	276	286	292	299
299	305	310	314	317	327	336	340	343	347
355	360	365	366	367	373	381	387	387	392
402	402	405	410	413	420	420	426	436	440
441	447	454	463	466	468	474	477	481	485
492	494	502	508	516	522	523	524	524	524

(6 points)

9. **Use the information in the table to answer the probability questions (a) - (d).**

Favorite Basketball Team	Home State: Arizona	California	Oregon	Total
Phoenix Suns	160	60	30	250
Sacramento Kings	20	270	10	300
Portland Trailblazers	20	70	160	250
Total	200	400	200	800

(a) What is the probability that a randomly selected person from this survey would be from California?

$\frac{400}{800}$ $\quad \frac{\#\text{ from CA}}{\#\text{ overall}}$

(b) What is the probability that a randomly selected person's favorite team would be the Sacramento Kings given that the person is from Arizona?

$P(\text{Kings} \mid \cancel{AZ}) = 20/200$

$= \frac{P(\text{kings and AZ})}{P(AZ)} = \frac{20/800}{200/800} = \left(\frac{20}{\cancel{800}}\right)\left(\frac{\cancel{800}}{200}\right) = \frac{20}{200}$

(c) What is the probability that a randomly selected person would be from Oregon or have the Portland Trailblazers as their favorite team?

$P(\text{OR or Trailblazers}) = P(OR) + P(\text{Trailblazers}) - P(\text{both})$

$= \frac{200}{800} + \frac{250}{800} - \frac{160}{800} = \frac{290}{800}$

(d) What is the probability that a randomly selected person's favorite team would be the Sacramento Kings given that the person is from Oregon?

$P(\text{Kings} \mid OR) = 10/200$

(e) Use your answers from part (b) and part (d) to demonstrate whether or not a person's preference of team is independent of their home state *[1 point extra credit - do this last]*.

preference is dependent, not independent, of home state.

$P(\text{kings} \mid AZ) = 0.10 \qquad P(\text{Kings} \mid OR) = 0.05$

So, home state changes P(Kings).

Therefore, dependent.

(5 points)

10. A collection of 20 dice includes 4 bad dice (not balanced correctly) and 16 dice that are good (balanced correctly).

    (a) What is the probability that a random sample of four of the 20 dice (without replacement) will have the exact sequence : "Good", "Good", "Good", "Bad" ?

$$\left(\frac{16}{20}\right)\left(\frac{15}{19}\right)\left(\frac{14}{18}\right)\left(\frac{4}{17}\right) = 0.116$$

    (b) What is the probability that a random sample of four of the 20 dice (without replacement) will have at least one "Bad" die?

P(at least one bad) = 1 − P(all good)

$$= 1 - \frac{16 \cdot 15 \cdot 14 \cdot 13}{20 \cdot 19 \cdot 18 \cdot 17} = 1 - 0.3756$$

$$= 0.6244$$

(2 points)

11. At an athletic contest, performers are judged by three judges. Each judge scores each performer as a 1, 2, 3, 4, 5, or a "perfect" 6. How many different sequences of scores from Judge1, Judge2, and Judge 3 are possible?

Example:

2	2	5
Judge 1	**Judge 2**	**Judge 3**

6 ways / Judge 1   6 ways / Judge 2   6 ways / Judge 3

fundamental counting rule

together, they can happen in $6 \times 6 \times 6 = 216$ ways

(2 points)

12. In an office, there are six workers and all of them have equal seniority. If there are six desks, how many ways can the six workers be assigned to the six desks?

$\underset{\text{Desk 1}}{6} \cdot \underset{D2}{5} \cdot \underset{D3}{4} \cdot \underset{D4}{3} \cdot \underset{D5}{2} \cdot \underset{D6}{1} = 6!$ ways

= 720 ways

(2 points)

13. In the same office as problem 12, the manager decides to assign the six workers to the six desks randomly. What is the probability that the random assignments result in the workers being assigned to the desk in the same order as their ages from oldest to youngest?

this can happen in only one way out of 720 equally likey outcomes.

prob. = 1/720

(3 points)

14. **A rich man has 14 close friends. He decides to invite three of these friends to join him on a voyage around the world. If the man selects his three traveling companions at random, how many different traveling groups could be formed?**

order is not important,
only the combination or group of people selected.

$_{14}C_3 = 364$ different groups are possible.

6. **Use the data in the following table to answer parts (a) through (e).**

(2 points, 1 minutes)

(a) What is the probability that a randomly selected person from this sample will be a factory worker?

$182/490$

	Employment Type for People in Sample				
State	**Farm**	**Factory**	**Gov'ment**	**Service**	**Total**
Arizona	**21**	**36**	**14**	**29**	**100**
California	**28**	**32**	**11**	**49**	**120**
Nevada	**19**	**41**	**13**	**7**	**80**
Oregon	**24**	**37**	**14**	**15**	**90**
Washington	**15**	**36**	**13**	**36**	**100**
Total	**107**	**182**	**65**	**136**	**490**

(2 points, 2 minutes)

(b) What is the probability that a person randomly selected form this sample will be from California given that the person works in the Service industry?

$$49/136 = \frac{P(\text{CA and Service})}{P(\text{Service})} = \frac{49/490}{136/490} = 49/136$$

(3 points, 3 minutes)

(c) What is the probability that a person randomly selected form this sample will be from Oregon or work in government?

$$P(\text{OR or Gov't}) = P(\text{OR}) + P(\text{gov't}) - P(\text{OR and Gov't})$$

$$= \frac{90}{490} + \frac{65}{490} - \frac{14}{490} = \frac{141}{490}$$

(2 points, 2 minutes)

(d) What is the probability that a person randomly selected form this sample will be from Arizona or Washington?

$$P(\text{AZ OR WA}) = P(\text{AZ}) + P(\text{WA}) - \underbrace{P(\text{AZ and WA})}_{=0 \text{ since No overlap.}}$$

$$= \frac{100}{490} + \frac{100}{490} = \frac{200}{490}$$

Extra Counting Problems

(3 points: 4 minutes)

3. **The local Police force has been accused of being insensitive to racial differences among the officers in the force. To answer the charges and to try to increase the multi-cultural awareness of officers, all the teams of two partners are mixed up and reassigned as new teams. If there are 16 officers on the force, how many different teams of two officers could possibly be formed?**

A "team" of (A and B) is the same as (B and A), so order does not matter.

$${}_{16}C_2 = 120 \text{ possible teams}$$

(3 points: 4 minutes)

4. **On the same police force as used in Problem 3, the 16 officers include 8 White officers, 4 Latino officers, 2 Black officers, and 2 Asian officers. If the entire department forms one line to take a picture, how many different racial sequences would be possible from left to right?**

$16 = N$
$8 = n_1$
$4 = n_2$
$2 = n_3$
$2 = n_4$

The number of different racial sequences =

$$\frac{N!}{n_1!\,n_2!\,n_3!\,n_4!} = \frac{16!}{8!\,4!\,2!\,2!} = 5,405,400$$

(3 points: 4 minutes)

5. **A police officer gets stuck one day with an unwelcome job – defusing a bomb – because the bomb squad's truck will not start. The officer sees a red wire, a white wire, a green wire, and a black wire. To stop the bomb, two wires must be cut. Because the officer has no better idea what to do, he decides to cut one wire and then another at random. What is the sample space for the officer's experiment? Also, what is the probability that the officer randomly selects the correct choice of two wires to cut to stop the bomb from exploding?**

Red
White
Green
Black

RW	WR	GR	BR	Sample Space
RG	WG	GW	BW	
RB	WB	GB	BG	

Each pair appears twice, ~~once~~ once as XY and again as YX.

$$P(\text{Pick correct pair of wires}) = 2/12 = 0.167$$

(6 points: 6 minutes)

11. The "Bomb Squad" must disable a terrorist bomb. This bomb has 6 wires. Three wires must be cut, but only the right 3 wires. All the wires are RED. For this situation, answer part (a) and part (b).

(a) How many sets of three wires are possible for the Bomb Squad to choose?

Each set is a group or combination — order does not matter.

$${}_6C_3 = 20$$

(b) If the Bomb Squad must choose the right 3 in the right order "OR ELSE!", and they must choose at random, what is the probability the bomb does not explode?

Now, order does matter, and ${}_6P_3 = 120$.

P(the single correct permutation is selected) = $1/120$

(2 points)

11. At an athletic contest, performers are judged by three judges. Each judge scores each performer as a 1, 2, 3, 4, 5, or a "perfect" 6. How many different sequences of scores from Judge1, Judge2, and Judge 3 are possible?

Repeat of problem in the Unit 1 Example Exam Qs.

(2 points)

12. In an office, there are six workers and all of them have equal seniority. If there are six desks, how many ways can the six workers be assigned to the six desks?

(5 points)

10. A box of 80 spark plugs for car engines includes 70 good ones and 10 bad ones.

(a) If two spark plugs are selected at random (without replacement) what is the probability that the first will be bad and the second will also be bad?

$$P(B \text{ and } B) = P(B) \cdot P(B|B) = \left(\frac{10}{80}\right)\left(\frac{9}{79}\right)$$

$$= \frac{90}{6320} = \boxed{0.0142}$$

(b) What is the probability that a random sample of six spark plugs (without replacement) will have at least one "Bad" one?

$$P(\text{at least one bad}) = 1 - P(\text{all 6 are Good})$$

$$= 1 - \left(\frac{70}{80}\right)\left(\frac{69}{79}\right)\left(\frac{68}{78}\right)\left(\frac{67}{77}\right)\left(\frac{66}{76}\right)\left(\frac{65}{75}\right) = 1 - 0.4363$$

$$= \boxed{0.5637}$$

(2 points)

11. Olympic ice skaters are judged by ~~three~~ six judges. If each judge can score each performer as a 1, 2, 3, 4, 5, or a "perfect" 6 (no decimals), how many different sequences of scores from the six judges are possible?

Example:

2	2	5	2	2	5
Judge 1	Judge 2	Judge 3	Judge ~~1~~ 4	Judge ~~2~~ 5	Judge ~~3~~ 6

$6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 = \boxed{46,656}$ different sequences of scores.

(2 points)

12. A carnival has 13 different "game" booths. The manager has to assign places along the "midway". How many different ways can the manager arrange the booths along one side of the path that customers walk?

Factorial $13!$ or ${}_{13}P_{13} = 6227020800$ different arrangements

(2 points)

13. For the carnival in problem 12 (above), the manager has a problem: there is only room for 9 of the 13 game booths at the next town. How many ways could the manager choose the 9 booths that will set up and operate when the show arrives at the next town?

ways to choose 9 out of 13 — but here order does not matter

${}_{13}C_9 = 715$ ways

(4 points)

16. **A business analyst determines that a new business will earn $100,000 in profits if it is successful, but it will lose $20,000 if it fails. If the probability of success is 0.85 and the probability of failure is 0.15, what is the expected value of a decision to start the new business?**

$\boxed{\text{Not responsible for "Expected Value" problems.}}$

$E(x) = \Sigma x \cdot P(x)$

$= \mu$

x	$P(x)$	$x \cdot P(x)$
100,000	0.85	85,000
−20,000	0.15	−3,000
		\$82,000

$E(x) = \$82,000$

(4 points)

17. **A manufacturing process produces silicon chips. The frequency (at random) of defective chips is 0.3. In a random sample of 6 silicon chips, what is the probability that the number of defective chips will be zero or one? [Assume the sample comes from a population of millions of chips so the selections are independent and have the same probability of being defective.]**

For full credit, calculate the probability.
For almost full credit, set up the full solution to the problem.

$N = 6$
$p = 0.3$
$q = 0.7$
$x = 0, 1$

Binomial

$P(0 \text{ or } 1) = P(0) + P(1)$

$= {}_6C_0 (0.3)^0 (0.7)^6 +$

${}_6C_1 (0.3)^1 (0.7)^5$

$= 0.1176 + 0.3025$

$= 0.4201$

(6 points)

15. **For each discrete probability distribution below, calculate the mean, variance, and standard deviation. [Use extra columns however you want to.]**

(a)

x	P(x)	$x \cdot P(x)$		$(x-\mu)^2 \cdot P(x)$		
0	0.2	0		0.162		
1	0.7	0.7		0.007		
2	0.1	0.2		0.121		

$\Sigma P(x) = 1$ valid

0.9 $\quad$ 0.290

$\Sigma\, x \cdot P(x) = \mu$

$\Sigma (x-\mu)^2 \cdot P(x) = \sigma^2$

$\sqrt{\sigma^2} = \sigma = 0.539$

(b)

x	P(x)					
10	0.2					
20	0.5					
30	0.4					

$\Sigma P(x) = 1.1$

Not valid.

(4 points)

16. **A business analyst determines that a new business will earn $100,000 in profits if it is successful, but it will lose $20,000 if it fails. If the probability of success is 0.85 and the probability of failure is 0.15, what is the expected value of a decision to start the new business?**

Repeat Page

(4 points)

17. **A manufacturing process produces silicon chips. The frequency (at random) of defective chips is 0.3. In a random sample of 6 silicon chips, what is the probability that the number of defective chips will be zero or one? [Assume the sample comes from a population of millions of chips so the selections are independent and have the same probability of being defective.]**

    For full credit, calculate the probability.
    For almost full credit, set up the full solution to the problem.

(5 minutes)

11. **The number of boys in 168 births is distributed binomially with n = 168 and p = 0.50. If there are 70 boys in a randomly selected set of 168 births, is that result unusual?**

70 is unusual if $|Z| = \left|\frac{70-\mu}{\sigma}\right|$ is > 2.

$\mu = np = (168)(0.50) = 84$

$\sigma = \sqrt{npq} = \sqrt{(168)(.5)(.5)} = 6.48$

$Z = \frac{70-84}{6.48}$

$= -2.16$

Yes, 70 boys would be unusually few $\rightarrow$ $|Z| > 2$

(8 minutes)

12. **An investment opportunity has two possible outcomes. The investor may earn \$100 or the investor may lose \$20. If the probability of earning \$100 is 0.26 and the probability of losing \$20 is 0.74, what is the expected value of the investment.**

Not responsible for "Expected Value" problems

x	$P(x)$	$x \cdot P(x)$
+ 100	0.26	26.00
- 20	0.74	-14.80

$\sum x \cdot p(x) = E(x) = \$11.20$