

1.2 Random Samples with work

1.1 HW

1. An individual is a member of the population of interest. A variable is an aspect of an individual subject or object being measured.
5. a) Nominal level. There is no apparent order relationship among responses.
b) Ordinal level. There is an increasing relationship from worst to best level of service. The interval between service levels is not meaningful, nor are ratios.
7. a) Meal ordered at fast-food restaurants.
b) Qualitative.
c) Response for *all* adult fast-food customers in the U.S.
9. a) Nitrogen concentration
b) Quantitative
c) Nitrogen concentration in the entire lake.
11. a) Ratio b) Interval. c) Nominal d) Ordinal e) Ratio f) Ratio
13. a) Nominal b) Ratio c) Interval d) Ordinal e) Ratio f) Interval
15. (Answers can be different here)
a) use pounds. round weights to the nearest lb.
b) some students may not allow you to weigh their backpack for privacy reasons
c) Possibly. Some students may want to impress you with the heaviness of their backpack, or they may be embarrassed about the "junk" they have inside and then clean out their backpack

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1.2 Random Samples

Essential Questions:

- What types of sampling exist?
- What types of bias/issues can occur?

Focus Points:

- Explain the importance of random samples.
- Construct a simple random sample using random numbers.
- Simulate a random process.
- Describe stratified sampling, cluster sampling, systematic sampling, multistage sampling, and convenience sampling.

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A **simple random sample (SRS)** of n measurements from a population is a subset of the population selected in such a manner that every sample of size n from the population has an equal chance of being selected.

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IMPORTANT FEATURES OF A SIMPLE RANDOM SAMPLE:

For an SRS:

- Every sample of specified size n for the population has an equal chance of being selected.
- No researcher bias occurs in the items selected for the sample.
- A random sample may not always reflect the diversity of the population. For instance, from a population of 10 cats and 10 dogs, a random sample of size 6 could consist of all cats.

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Example 1: Simple Random Sample (SRS)
Is open space around metropolitan areas important? Players of the Colorado Lottery might think so, since some of the proceeds of the game go to fund open space and outdoor recreational space. To play the game, you pay \$1 and choose any six different number from the group of numbers 1 through 42. If your group of six numbers matches the winning group of six numbers selected by SRS, then you are a winner of a grand prize of at least \$1.5 million.

a) Is the number 25 as likely to be selected in the winning group of six numbers as the number 5? **YES**

b) Could all the winning numbers be even? **YES**

c) Your friend always plays the numbers 1, 2, 3, 4, 5, 6. Could she ever win? **YES**

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Example 1: Simple Random Sample (SRS)
Is open space around metropolitan areas important? Players of the Colorado Lottery might think so, since some of the proceeds of the game go to fund open space and outdoor recreational space. To play the game, you pay \$1 and choose any six different number from the group of numbers 1 through 42. If your group of six numbers matches the winning group of six numbers selected by SRS, then you are a winner of a grand prize of at least \$1.5 million.

a) Is the number 25 as likely to be selected in the winning group of six numbers as the number 5? **Yes, Because the winning numbers constitute a SRS, each number from 1 - 42 has an equal chance of being selected.**

b) Could all the winning numbers be even? **Yes, since six even numbers is one of the possible groups of six numbers.**

c) Your friend always plays the numbers 1, 2, 3, 4, 5, 6. Could she ever win. **Yes. In a SRS, the listed group of 6 numbers is as likely as any of the 5, 245,786 possible groups of 6 numbers to be selected as the winner.**

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1.2 Random Samples with work

How do we get random numbers?

- most calculators
- internet has random number generators
- random-number table
- drawing numbers from a "hat"

Random Number on Calc

- MATH - PRB - 5
- (smallest #, biggest #)
- ENTER

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Random Number Table Practice

Use a random-number table to pick a random sample of 30 cars from a population of 500 cars.

STEPS:

1. number the cars. 001 - 500
 2. pick a row from the random-number table 3
 3. start picking your numbers until you have your sample of 30 cars randomly selected. 196
386
500
40
- 59654 71966 27386 50004 05358

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TABLE 1 Random Numbers									
52630	78240	19267	95157	53697	73894	37708	79862	76471	66418
70445	78735	71549	44843	26104	67318	00701	34986	66751	99723
59554	71966	27386	50004	05358	94031	29281	18544	52429	06080
31524	49587	76612	39789	13537	48086	59483	60680	84675	53014
06348	76938	90379	51392	55887	71015	09209	79157	24440	30244
28703	51709	94456	48396	73780	06436	86641	69239	57662	80181
69108	89266	94730	95761	75023	48464	65544	96583	18911	16391
99938	90704	93621	66330	33393	95261	95349	51769	91616	33238
91543	73196	34449	63513	83834	99411	58826	40456	69768	48562
42103	02781	73920	56297	72678	12249	25270	36678	21313	75767
17138	27584	25296	28387	51390	61664	37893	05363	44143	42677
28297	14280	54524	21618	95320	38174	60579	08089	94999	78460
09331	36712	51333	06289	75345	08811	82711	57392	25252	30333
31295	04204	93712	51287	05754	79396	87399	51773	33075	97061
36146	15560	27592	42089	99281	59640	15221	96079	09961	05371
25553	18432	13630	05529	02791	81017	49027	79031	50912	09399
23501	22642	63081	08191	89420	67800	55137	54707	32945	64522
57888	85846	67967	07835	11314	01545	48535	17142	08552	67457
55336	71264	88472	04334	63919	36394	11196	92470	70543	29776
10087	10072	55980	64688	68239	20461	89381	93809	00796	95945
34101	81277	66090	88872	37818	72142	67140	50285	31100	51100
53362	44980	64300	88872	37818	72142	67140	50285	31100	51100

Write down as you get your numbers.

A **simulation** is a numerical facsimile or representation of a real-world phenomenon.

That was a simulation using the random-number table. We also could have done a simulation with... **hat, calculator, or computer.**

Which is "simple" for a SRS?

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Example 2: Simulation

Use a random-number table to simulate the outcomes of tossing a balanced (that is, fair) penny 10 times. **06348 76398**

- How many outcomes are possible when you toss a coin at once? **2: Heads/Tails**
- There are several ways to assign numbers to the two outcomes. Because we assume a fair coin, we can assign an even digit to the outcome "heads" and an odd digit to the outcome "tails." Then, starting at block 3 of row 2 in the random-number table, list the first 10 single digits. **HHTHH THTH**
- What are the outcomes associated with the 10 digits?
- If you start in a different block and row of the random-number table, will you get the same sequence of outcomes?

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Example 2: Simulation

Use a random-number table to simulate the outcomes of tossing a balanced (that is, fair) penny 10 times.

- How many outcomes are possible when you toss a coin at once? **Two - heads or tails**
- There are several ways to assign numbers to the two outcomes. Because we assume a fair coin, we can assign an even digit to the outcome "heads" and an odd digit to the outcome "tails." Then, starting at block 3 of row 2 in the random-number table, list the first 10 single digits. **7, 1, 5, 4, 9, 4, 4, 8, 4, 3**
- What are the outcomes associated with the 10 digits? **T, T, T, H, T, H, H, H, H, T**
- If you start in a different block and row of the random-number table, will you get the same sequence of outcomes? **It is possible, but not very likely.**

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1.2 Random Samples with work

Sampling with replacement means that although a number is selected for the sample, it is *not removed* from the population. Therefore, the same number may be selected for the same sample more than once.

Sampling without replacement means that the number *is removed* for good and cannot be chosen again. This will *change the probability* of the remaining objects in the population.

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OTHER SAMPLING TECHNIQUES

Random sampling: Use a simple random sample from the entire population.
Stratified sampling: Divide the entire population into distinct subgroups called strata. The strata are based on a specific characteristic such as age, income, education level, and so on. All members of a stratum share the specific characteristic. Draw random samples from each stratum.
Systematic sampling: Number all members of the population sequentially. Then, from a starting point selected at random, include every k th member of the population in the sample.
Cluster sampling: Divide the entire population into pre-existing segments or clusters. The clusters are often geographic. Make a random selection of clusters. Include every member of each selected cluster in the sample.
Multistage sampling: Use a variety of sampling methods to create successively smaller groups at each stage. The final sample consists of clusters.
Convenience sampling: Create a sample by using data from population members that are readily available.

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Once you have a sample selected we call the list of individuals from which a sample is actually selected the **sampling frame**.

SAMPLING PROBLEMS

Undercoverage results from omitting population members from the sample frame.

A **sampling error** is the difference between measurements from a sample and corresponding measurements from the respective population. It is caused by the fact that the sample **does not** perfectly represent the population.

A **nonsampling error** is the result of poor sample design, sloppy data collection, faulty measuring instruments, bias in questionnaires, and so on.

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HW: pg. 18: 1, 3, 5, 7, 9, 11, 13, 15, 19

Be sure to check your answers in the back of the book. We will go over these tomorrow in class before you place it in your folder.

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