SECTION 1.3 – Simple Random Sampling

Random sampling – The process of using chance to select individuals from a population to be included in a sample.

Simple random sampling – Where a sample of size n from a population of size N is obtained if every possible sample of size n has an equally likely chance of occurring.

Simple random sample (SRS) – The sample obtained by the process of simple random sampling.

Sampling without replacement – Simple random sampling where a member of the population can be selected at most once.

Sampling with replacement – Simple random sampling where a member of the population can be selected more than once.

Table 1 – Random Numbers

Column→ Row↓	01-05	06-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
01	89392	23212	74483	36590	25956	36544	68518	40805	09980	00467
02	61458	17639	96252	95649	73727	33912	72896	66218	52341	97141
03	11452	74197	81962	48433	90360	26480	73231	37740	26628	44690
04	27575	04429	31308	02241	01698	19191	18948	78871	36030	23980
05	36829	59109	88976	46845	28329	47460	88944	08264	00843	84592
06	81902	93458	42161	26099	09419	89073	82849	09160	61845	40906
07	59761	55212	33360	68751	86737	79743	85262	31887	37879	17525
08	46827	25906	64708	20307	78423	15910	86548	08763	47050	18513
09	24040	66449	32353	83668	13874	86741	81312	54185	78824	00718
10	98144	96372	50277	15571	82261	66628	31457	00377	63423	55141
11	14228	17930	30118	00438	49666	65189	62869	31304	17117	71489
12	55366	51057	90065	14791	62426	02957	88518	28822	30588	32798
13	96101	30646	35526	90389	73634	79304	96635	06626	94683	16696
14	38152	55474	30153	26525	83647	31988	82182	98377	33802	80471
15	85007	18416	24661	95581	45868	15662	28906	36392	07617	50248
16	85544	15890	80011	18160	33468	84106	40603	01315	74664	20553
17	10446	20699	98370	17684	16932	80449	92654	02084	19985	59321
18	67237	45509	17638	65115	29757	80705	82686	48565	72612	61760
19	23026	89817	05403	82209	30573	47501	00135	33955	50250	72592
20	67411	58542	18678	46491	13219	84084	27783	34508	55158	78742

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☺ **Example #1a:**
In the state of Arizona, there are 13 National Monuments from the statewide 21 National Park System (NPS) official units. The 13 National Monuments are listed below in order by the year they were established:

Montezuma Castle (1906), Tonto (1907), Navajo (1909), Walnut Canyon (1915), Casa Grande Ruins (1918), Pipe Spring (1923), Chiricahua (1924), Wupatki (1924), Sunset Crater Volcano (1930), Canyon de Chelly (1931), Organ Pipe Cactus (1937), Tuzigoot (1939), & Hohokam Pima (1972).

A family wants to visit **3** different national monuments. Using Table 1, find a simple random sample of size 3, by starting on Row #06 and Column #12, proceeding to the right.

Solution → First off, place and label the names of the national monuments in alphabetical/numerical order.

01	Canyon de Chelly	04	Hohokam Pima	07	Organ Pipe Cactus	10	Tonto	13	Wupatki
02	Casa Grande Ruins	05	Montezuma Castle	08	Pipe Spring	11	Tuzigoot		
03	Chiricahua	06	Navajo	09	Sunset Crater Volcano	12	Walnut Canyon		

Column→ Row↓	01-05	06-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
06	81902	93458	42161	26099	09419	89073	82849	09160	61845	40906

(Partial Table I shown above). So, from Table I, starting on Row #06 and Column #12, we see that we are starting with 21, since we are looking for two-digit numbers. Proceeding to the right, we have the following random numbers generated:

21 61 26 **09** 90 94 19 89 **07** 38 28 49 ***09*** 16 **06** 18 45 40 90

The first three eligible numbers that appear from the list above are **09**, **07**, and **09**. RSince, this sample is without replacement, we skip the 'duplicate' numbers (in this case the second ***09***) and proceed until three distinct numbers are generated, which will be **09**, **07**, and **06** So, from the labels, the sample of size three will consist of Sunset Crater Volcano, Organ Pipe Cactus, and Navajo.

Column→ Row↓	26-30	31-35
01	36544	68518
02	33912	72896
03	26480	73231
04	19191	18948
05	47460	88944
06	89073	82849
07	79743	85262
08	15910	86548
09	86741	81312
10	66628	31457
11	65189	62869
12	02957	88518
13	79304	96635
14	31988	82182
15	15662	28906
16	84106	40603
17	80449	92654
18	80705	82686
19	47501	00135
20	84084	27783

☺ **Example #1b:**
Using Table I, find a simple random sample of size 4, by starting on Row #11 and Column #28, proceeding downward. If/when a column is complete at the bottom, continue over to the next column to the right at the top and proceed downwards.

Solution → (Partial Table I shown to the right). So, starting on Row #11 and Column #28, we see that we are starting with 18, since we are looking for two-digit numbers. Proceeding downwards, we have the following random numbers generated:

18 95 30 98 66 **10** 44 70 50 **08**

We only come up with a sample of two here, yet we need four. So, we now continue onwards to the next column to the right and proceed downwards. In this case we would be at Row #01, Column #30. The next set of numbers generated is

46 27 **07** **11** 08 38 38 08 18 83 96 78 49 88 22 64 99 58 10 42

Thus, the first four eligible numbers that appear from the list using both sets of columns are **10**, **08**, **07**, and **11**. So, the sample of size four will consist of Tonto, Pipe Spring, Organ Pipe Cactus, and Tuzigoot.

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☺ **Exercises:**

1) The 2016 Olympics were held in Rio de Janeiro. There were 87 different countries that won at least one medal in those Olympics. Those countries are listed below:

01	Algeria	19	Cuba	37	Indonesia	55	Netherlands	73	South Korea
02	Argentina	20	Czech Republic	38	Iran	56	New Zealand	74	Spain
03	Armenia	21	Denmark	39	Ireland	57	Nigeria	75	Sweden
04	Australia	22	Dominican Republic	40	Israel	58	Niger	76	Switzerland
05	Austria	23	Egypt	41	Italy	59	North Korea	77	Tajikistan
06	Azerbaijan	24	Estonia	42	Ivory Coast	60	Norway	78	Thailand
07	Bahamas	25	Ethiopia	43	Jamaica	61	Philippines	79	Trinidad and Tobago
08	Bahrain	26	Fiji	44	Japan	62	Poland	80	Tunisia
09	Belarus	27	Finland	45	Jordan	63	Portugal	81	Turkey
10	Belgium	28	France	46	Kazakhstan	64	Puerto Rico	82	Ukraine
11	Brazil	29	Georgia	47	Kenya	65	Qatar	83	United Arab Emirates
12	Bulgaria	30	Germany	48	Kosovo	66	Romania	84	United States
13	Burundi	31	Great Britain	49	Lithuania	67	Russia	85	Uzbekistan
14	Canada	32	Greece	50	Malaysia	68	Serbia	86	Venezuela
15	China	33	Grenada	51	Mexico	69	Singapore	87	Vietnam
16	Chinese Taipei	34	Hungary	52	Moldova	70	Slovakia		
17	Colombia	35	Ind. Olympic Athletes	53	Mongolia	71	Slovenia		
18	Croatia	36	India	54	Morocco	72	South Africa		

a) Using Table 1, find an SRS of size 4, by starting on Row #17 and Column #01, proceeding to the right. If/when a row is complete at the right, continue over to the next row below and proceed to the right.

b) Using Table 1, find an SRS of size 3, by starting on Row #11 and Column #18, proceeding to the right. If/when a row is complete at the right, continue over to the next row below and proceed to the right.

c) Using Table 1, find an SRS of size 5, by starting on Row #05 and Column #05, proceeding downwards. If/when a column is complete at the bottom, continue over to the next column to the right at the top and proceed downwards.

d) Using Table 1, find an SRS of size 5, by starting on Row #03 and Column #41, proceeding upwards. If/when a column is complete at the top, continue over to the next column to the right at the bottom and proceed upwards.

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☺ **Exercises:**

2) In the 2019 NFL season, the 6 NFC teams that made the playoffs were the San Francisco 49ers, Green Bay Packers, New Orleans Saints, Philadelphia Eagles, Seattle Seahawks, and Minnesota Vikings.

a) List the 15 possible samples without replacement of two teams that can be selected from the six. For brevity, use SF, GB, NO, PHI, SEA, and MIN.

b) Describe a procedure for taking a simple random sample of two teams from the six.

c) If a simple random sample sampling procedure is used to obtain two teams, what are the chances of selecting the Packers and Vikings?

☺ **Multiple Choice Questions**:

3) In both astrology and historical astronomy, the Zodiac is a circle of twelve 30° divisions of celestial longitude that are centered upon the ecliptic: the apparent path of the Sun across the celestial sphere over the course of the year. Historically, these twelve divisions are called signs, which are listed below: (Note: The list is already alphabetized.)

Aquarius, Aries, Cancer, Capricorn, Gemini, Leo, Libra, Pisces, Sagittarius, Scorpio, Taurus, Virgo.

Using Table 1, find an SRS of size 2, by starting on Row #3 and Column #8, proceeding to the right. Which **one** of the following signs would be part of that sample of size 2? (If/when a row is complete at the right, continue onwards to the next row below and proceed to the right.)
A) Pisces **B)** Gemini **C)** Libra **D)** Leo **E)** Capricorn

4) Refer to Exercise #3, using Table 1, find an SRS of size 4, by starting on Row #04 and Column #07, proceeding downwards. Which one of the following signs would **not** be part of that sample? (If/when a column is complete at the bottom, continue onwards to the next column to the right at the top and proceed downwards.)
A) Virgo **B)** Scorpio **C)** Leo **D)** Taurus **E)** Sagittarius

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☺ **Answers to selected exercises**:
3) C ; **4)** D
