

# Sampling People, Records, & Networks

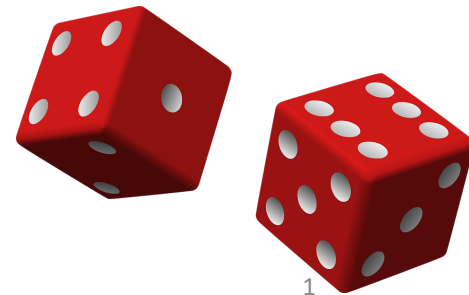
Jim Lepkowski, PhD

Professor & Research Professor *Emeritus*

Institute for Social Research, University of Michigan

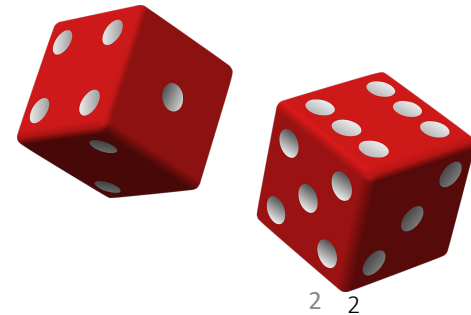
Research Professor,

Joint Program in Survey Methodology, University of Maryland

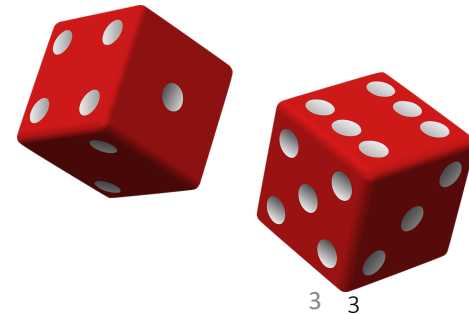


## Unit 5

- 1 Systematic selection
  - 2 Intervals with fractions
  - **3 List order**
  - 4 Uncertainty estimation
- Unit 1: Sampling as a research tool
  - Unit 2: Mere randomization
  - Unit 3: Saving money
  - Unit 4: Being more efficient
  - **Unit 5: Simplifying sampling**
    - 1 Systematic selection
    - 2 Intervals with fractions
    - **3 List order**
    - 4 Uncertainty estimation
  - Unit 6: Some extensions & applications



- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- Unit 1: Sampling as a research tool
  - Unit 2: Mere randomization
  - Unit 3: Saving money
  - Unit 4: Being more efficient
  - **Unit 5: Simplifying sampling**
    - 1 Systematic selection
    - 2 Intervals with fractions
    - **3 List order**
    - 4 Uncertainty estimation
  - Unit 6: Some extensions & applications



- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- List order combined with systematic selection can improve the efficiency (in terms of variance) of systematic sample designs
  - Arrange the list order in advance
  - Determines which kind of samples are selected
    - **Random** order: SRS

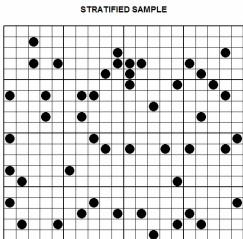


- Order plus selection
- **Random**
- Stratified
- Serpentine
- Linear trend
- Periodicity

No.	Date	Time	Reference	Category	Subcategory	Business	Additional information	Amount
1	20160617	13274200	32016172018491	Business services	Advertising services	NA	5556128901	\$833.24
2	20160617	13274203	32016172018492	Merchandise & supplies	Book stores	NA	5552697691	\$26.52
3	20160617	13274210	32016172018493	Other	Utilities	NA	5558518280	\$91.95
4	20160617	13274211	32016172018494	Business services	Mailing & shipping	NA	5554888725	\$17.70
5	20160617	13274211	32016172018495	Business services	Contracting services	NA	5558398606	\$150.66
6	20160617	13274217	32016172018496	Merchandise & supplies	General retail	NA	5552808987	\$80.14
7	20160617	13274218	32016172018497	Merchandise & supplies	Music & video	NA	5558102117	\$59.27
8	20160617	13274220	32016172018498	Merchandise & supplies	Music & video	NA	5557495061	\$85.04
9	20160617	13274230	32016172018499	Business services	Health care services	NA	5559321864	\$624.80
10	20160617	13274236	32016172018500	Restaurant	Restaurant	NA	5551869731	\$56.32
11	20160617	13274239	32016172018501	Merchandise & supplies	Groceries	NA	5554914804	\$82.33
12	20160617	13274240	32016172018502	Business services	Health care services	NA	5552682932	\$842.16
13	20160617	13274241	32016172018503	Business services	Health care services	NA	5551606583	\$971.30
14	20160617	13274242	32016172018504	Fees & adjustments	Fees & adjustments	NA	5558979830	\$73.57
15	20160617	13274249	32016172018505	Business services	Contracting services	NA	5558855254	\$128.74
16	20160617	13274251	32016172018506	Entertainment	Sports events	NA	5557903363	\$122.68
17	20160617	13274258	32016172018507	Travel	Lodging	NA	5554231047	\$241.15
18	20160617	13274266	32016172018508	Other	Miscellaneous	NA	5551339259	\$42.92
19	20160617	13274274	32016172018509	Business services	Health care services	NA	5555502637	\$1,071.25
20	20160617	13274282	32016172018510	Merchandise & supplies	Groceries	NA	5551386371	\$30.51
21	20160617	13274287	32016172018511	Entertainment	Other entertainment	NA	5551508827	\$28.13
22	20160617	13274296	32016172018512	Merchandise & supplies	Department stores	NA	5554661994	\$194.13
23	20160617	13274302	32016172018513	Other	Utilities	NA	5554438826	\$111.73
24	20160617	13274306	32016172018514	Business services	Health care services	NA	5559722356	\$694.48
25	20160617	13274310	32016172018515	Merchandise & supplies	Appliance stores	NA	5553447554	\$294.00



- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- List order combined with systematic selection can improve the efficiency (in terms of variance) of systematic sample designs
  - Arrange the list order in advance
  - Determines which kind of samples are selected
    - **Stratified** order

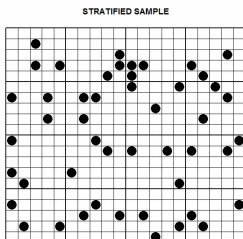




## Survey Data Collection & Analytic Specialization

## Sampling People, Records, & Networks

- Interval  $k=10$
- Order plus selection
- Interval tuned to size
- Conceptual framework
- **Stratified**
- Serpentine
- Linear trend
- Periodicity

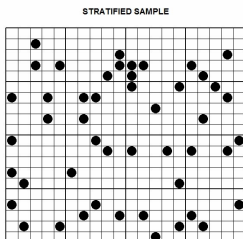


No.	Date	Time	Reference	Category	Subcategory	Business	Additional Information	Amount
1	20160617	13274200	32016172018491	Business services	Advertising services	NA	5556128901	\$833.24
459	20160617	13270582	32016172018949	Business services	Advertising services	NA	5555107132	\$158.56
782	20160617	13272189	32016172019272	Business services	Advertising services	NA	5559447619	\$808.94
861	20160617	13272572	32016172019351	Business services	Advertising services	NA	5558212515	\$904.80
184	20160617	13275145	32016172018674	Transportation	Air services	NA	5554349664	\$352.83
517	20160617	13270846	32016172019007	Transportation	Air services	NA	5554388338	\$183.28
578	20160617	13271157	32016172019068	Transportation	Air services	NA	5559017061	\$433.67
43	20160617	13274391	32016172018533	Travel	Airline	NA	5559725508	\$736.15
75	20160617	13274577	32016172018565	Travel	Airline	NA	5557816430	\$784.42
161	20160617	13275030	32016172018651	Travel	Airline	NA	5559193703	\$796.27
226	20160617	13275353	32016172018716	Travel	Airline	NA	5556256022	\$436.54
267	20160617	13275560	32016172018757	Travel	Airline	NA	5552019049	\$723.54
301	20160617	13275718	32016172018791	Travel	Airline	NA	5552781527	\$501.10
340	20160617	13275900	32016172018830	Travel	Airline	NA	5559249237	\$628.96
369	20160617	13270122	32016172018859	Travel	Airline	NA	5557443941	\$893.90
516	20160617	13270839	32016172019006	Travel	Airline	NA	5556182255	\$495.13
554	20160617	13271028	32016172019044	Travel	Airline	NA	5557813593	\$255.79
717	20160617	13271830	32016172019207	Travel	Airline	NA	5551337069	\$636.97
745	20160617	13271973	32016172019235	Travel	Airline	NA	5552675665	\$333.44
772	20160617	13272131	32016172019262	Travel	Airline	NA	5554075609	\$314.06
779	20160617	13272168	32016172019269	Travel	Airline	NA	5558938222	\$779.23
791	20160617	13272219	32016172019281	Travel	Airline	NA	5556429025	\$942.45
948	20160617	13273030	32016172019438	Travel	Airline	NA	5556318458	\$281.71
967	20160617	13273116	32016172019457	Travel	Airline	NA	5553765114	\$1,196.40
997	20160617	13273274	32016172019487	Travel	Airline	NA	5552764596	\$1,265.28

## Survey Data Collection & Analytic Specialization

## Sampling People, Records, & Networks

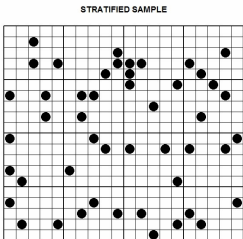
- Order plus selection
- Random
- **Stratified**
- Serpentine
- Linear trend
- Periodicity



No.	Date	Time	Reference	Category	Subcategory	Business	Additional information	Amount
1	20160617	13274200	32016172018491	Business services	Advertising services	NA	5556128901	\$833.24
459	20160617	13270582	32016172018949	Business services	Advertising services	NA	5555107132	\$158.56
782	20160617	13272189	32016172019272	Business services	Advertising services	NA	5559447619	\$808.94
861	20160617	13272572	32016172019351	Business services	Advertising services	NA	5558212515	\$904.80
30	20160617	13274324	32016172018520	Business services	Banking services	NA	5552175228	\$57.49
40	20160617	13274376	32016172018530	Business services	Banking services	NA	5551855504	\$26.95
122	20160617	13274849	32016172018612	Business services	Banking services	NA	5553815665	\$51.79
157	20160617	13275014	32016172018647	Business services	Banking services	NA	5554831620	\$113.69
219	20160617	13275317	32016172018709	Business services	Banking services	NA	5559333068	\$43.04
225	20160617	13275348	32016172018715	Business services	Banking services	NA	5558422465	\$54.32
257	20160617	13275499	32016172018747	Business services	Banking services	NA	5557587394	\$68.46
298	20160617	13275697	32016172018788	Business services	Banking services	NA	5555374371	\$83.72
331	20160617	13275865	32016172018821	Business services	Banking services	NA	5559995929	\$120.79
387	20160617	13270208	32016172018877	Business services	Banking services	NA	5553396644	\$70.01
394	20160617	13270253	32016172018884	Business services	Banking services	NA	5555705942	\$58.37
489	20160617	13270720	32016172018979	Business services	Banking services	NA	5557368687	\$95.09
510	20160617	13270808	32016172019000	Business services	Banking services	NA	5554944601	\$41.60
548	20160617	13270997	32016172019038	Business services	Banking services	NA	5556677787	\$28.39
550	20160617	13271004	32016172019040	Business services	Banking services	NA	5555587882	\$114.05
639	20160617	13271485	32016172019129	Business services	Banking services	NA	5555917577	\$121.14
715	20160617	13271821	32016172019205	Business services	Banking services	NA	5559489081	\$86.15
724	20160617	13271859	32016172019214	Business services	Banking services	NA	5555268523	\$95.48
746	20160617	13271974	32016172019236	Business services	Banking services	NA	5554021305	\$63.93
789	20160617	13272206	32016172019279	Business services	Banking services	NA	5558851608	\$23.56
242	20160617	13275437	32016172018732	Business services	Conferences & training	NA	5555509801	\$128.59

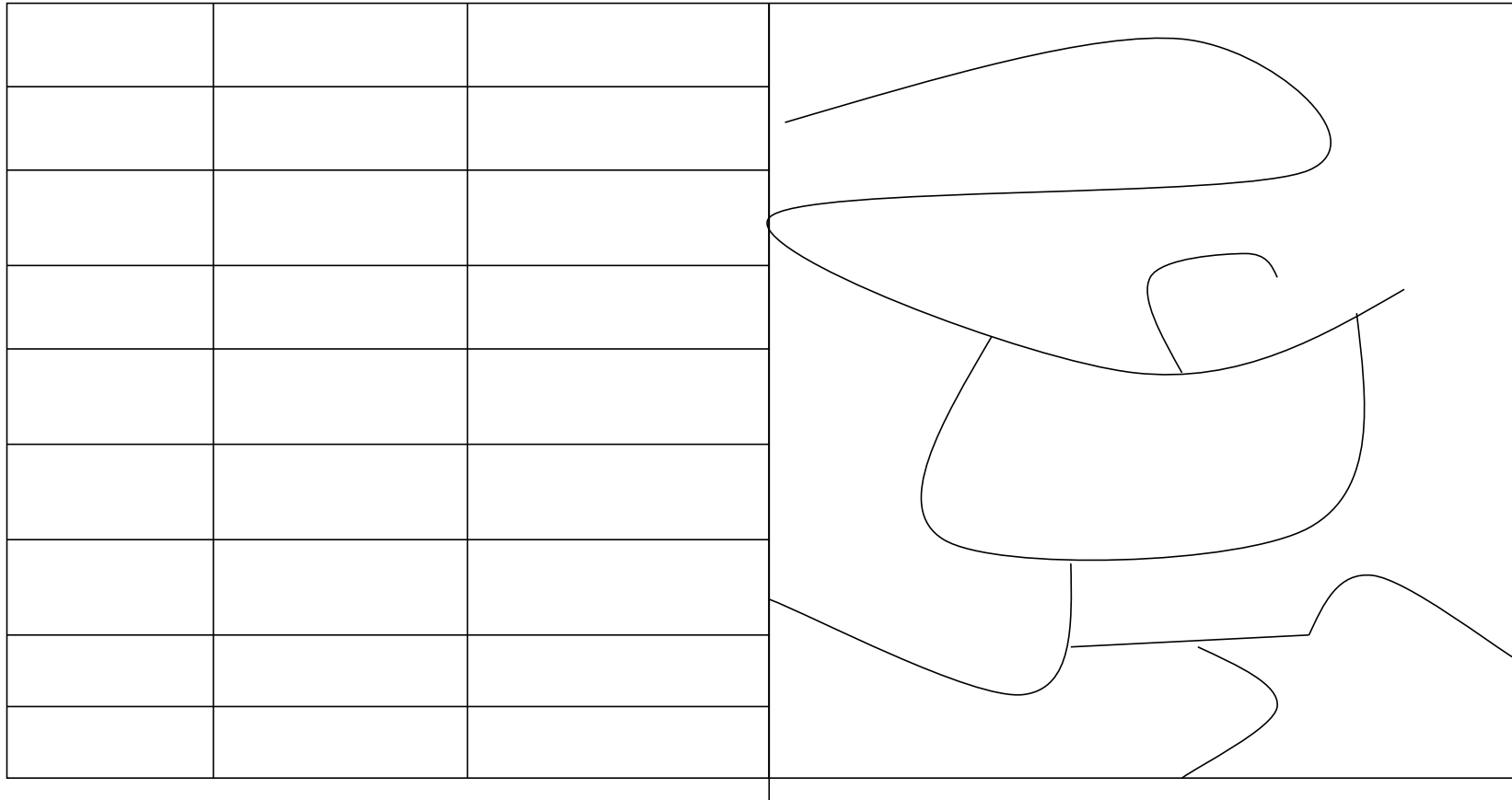


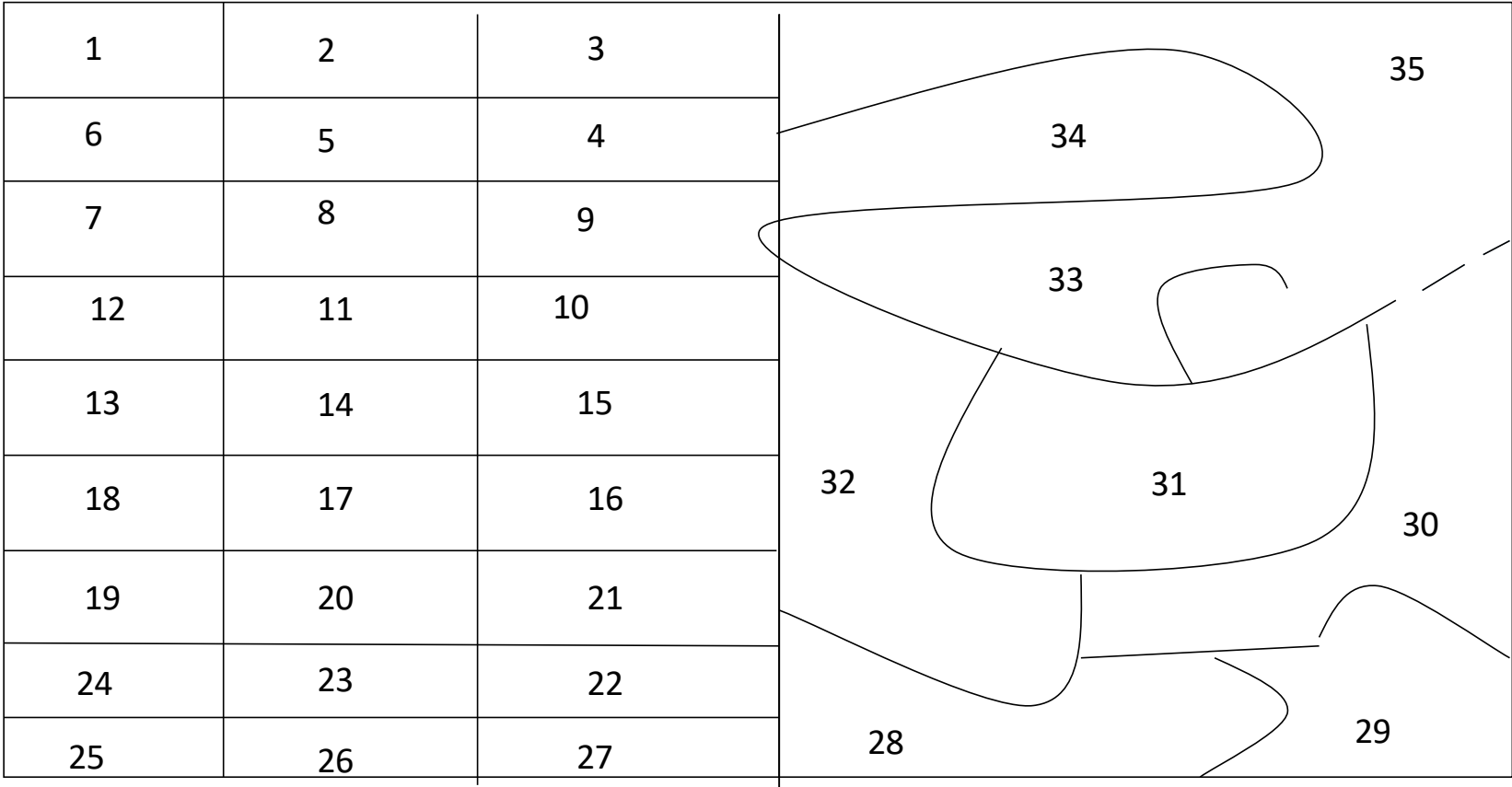
- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- List order combined with systematic selection can improve the efficiency (in terms of variance) of systematic sample designs
  - Arrange the list order in advance
  - Determines which kind of samples are selected
    - **Stratified** order
    - Gains in precision due to proportionately allocated stratified sampling ... implicitly

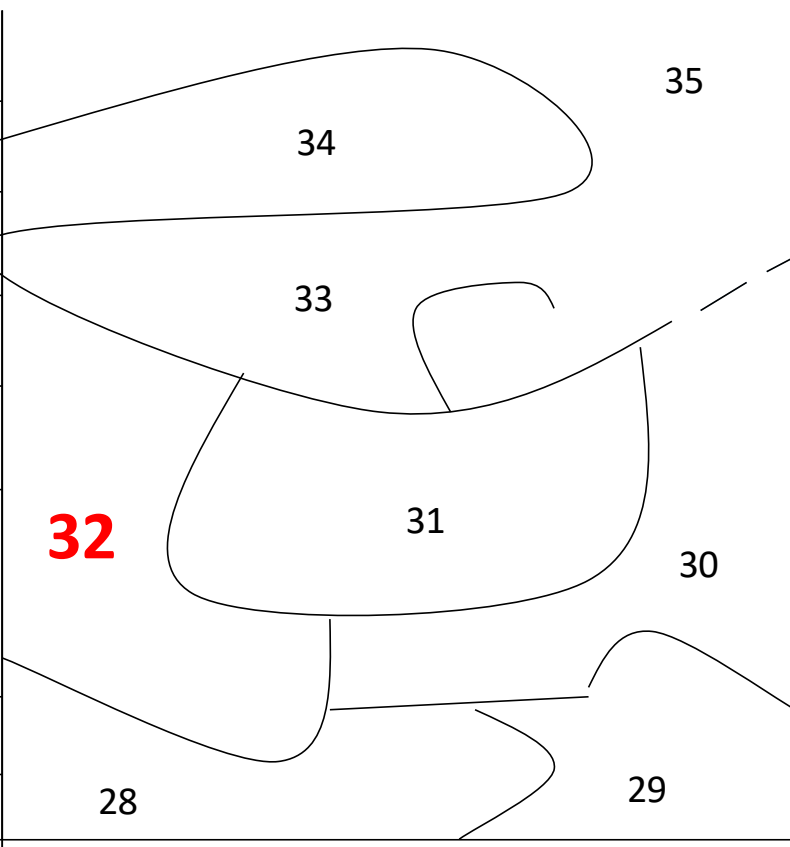


- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- List order combined with systematic selection can improve the efficiency (in terms of variance) of systematic sample designs
  - Arrange the list order in advance
  - Determines which kind of samples are selected
    - **Serpentine** order







1	2	3	
6	5	<b>4</b>	
7	8	9	
12	<b>11</b>	10	
13	14	15	
<b>18</b>	17	16	
19	20	21	
24	23	22	
<b>25</b>	26	27	



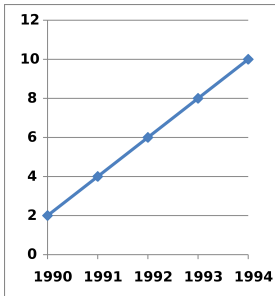
- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - **Linear trend**
  - Periodicity
- Some worry about trends of particular types that might arise in the data
    - **Linear trend** order



## Survey Data Collection & Analytic Specialization

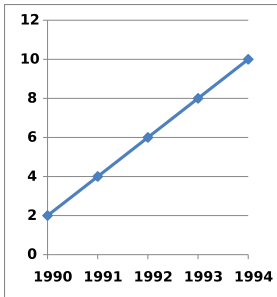
## Sampling People, Records, & Networks

- Interval  $k=10$
- Order plus selection
- Interval tuned to size
- Conceptual framework
- Stratified
- Serpentine
- Linear trend
- Periodicity

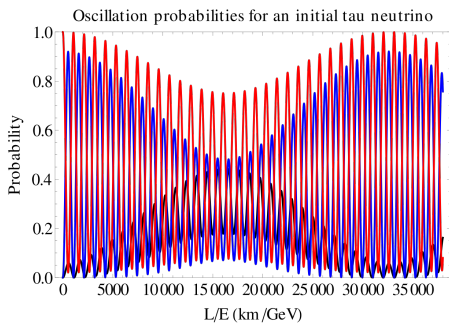


No.	Date	Time	Reference	Category	Subcategory	Business	Additional information	Amount
1	20160617	13274200	32016172018491	Business services	Advertising services	NA	5556128901	\$10.00
2	20160617	13274203	32016172018492	Merchandise & supplies	Book stores	NA	5552697691	\$20.00
3	20160617	13274210	32016172018493	Other	Utilities	NA	5558518280	\$30.00
4	20160617	13274211	32016172018494	Business services	Mailing & shipping	NA	5554888725	\$40.00
5	20160617	13274211	32016172018495	Business services	Contracting services	NA	5558398606	\$50.00
6	20160617	13274217	32016172018496	Merchandise & supplies	General retail	NA	5552808987	\$60.00
7	20160617	13274218	32016172018497	Merchandise & supplies	Music & video	NA	5558102117	\$70.00
8	20160617	13274220	32016172018498	Merchandise & supplies	Music & video	NA	5557495061	\$80.00
9	20160617	13274230	32016172018499	Business services	Health care services	NA	5559321864	\$90.00
10	20160617	13274236	32016172018500	Restaurant	Restaurant	NA	5551869731	\$100.00
11	20160617	13274239	32016172018501	Merchandise & supplies	Groceries	NA	5554914804	\$110.00
12	20160617	13274240	32016172018502	Business services	Health care services	NA	5552682932	\$120.00
13	20160617	13274241	32016172018503	Business services	Health care services	NA	5551606583	\$130.00
14	20160617	13274242	32016172018504	Fees & adjustments	Fees & adjustments	NA	5558979830	\$140.00
15	20160617	13274249	32016172018505	Business services	Contracting services	NA	5558855254	\$150.00
16	20160617	13274251	32016172018506	Entertainment	Sports events	NA	5557903363	\$160.00
17	20160617	13274258	32016172018507	Travel	Lodging	NA	5554231047	\$170.00
18	20160617	13274266	32016172018508	Other	Miscellaneous	NA	5551339259	\$180.00
19	20160617	13274274	32016172018509	Business services	Health care services	NA	5555502637	\$190.00
20	20160617	13274282	32016172018510	Merchandise & supplies	Groceries	NA	5551386371	\$200.00
21	20160617	13274287	32016172018511	Entertainment	Other entertainment	NA	5551508827	\$210.00
22	20160617	13274296	32016172018512	Merchandise & supplies	Department stores	NA	5554661994	\$220.00
23	20160617	13274302	32016172018513	Other	Utilities	NA	5554438826	\$230.00
24	20160617	13274306	32016172018514	Business services	Health care services	NA	5559722356	\$240.00
25	20160617	13274310	32016172018515	Merchandise & supplies	Appliance stores	NA	5553447554	\$250.00

- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - **Linear trend**
  - Periodicity
- Some worry about trends of particular types that might arise in the data
    - **Linear trend** order
    - Strong gains in precision



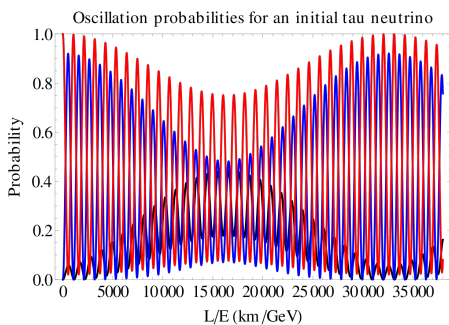
- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- Some worry about trends of particular types that might arise in the data
    - **Periodic trend** order





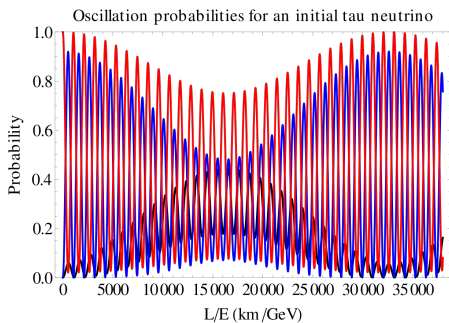
- Order plus selection
- Random
- Stratified
- Serpentine
- Linear trend
- **Periodicity**

No.	Date	Time	Reference	Category	Subcategory	Business	Additional information	Amount
1	20160617	13274200	32016172018491	Business services	Advertising services	NA	5556128901	\$10.00
2	20160617	13274203	32016172018492	Merchandise & supplies	Book stores	NA	5552697691	\$20.00
3	20160617	13274210	32016172018493	Other	Utilities	NA	5558518280	\$30.00
4	20160617	13274211	32016172018494	Business services	Mailing & shipping	NA	5554888725	\$40.00
5	20160617	13274211	32016172018495	Business services	Contracting services	NA	5558398606	\$50.00
6	20160617	13274217	32016172018496	Merchandise & supplies	General retail	NA	5552808987	\$60.00
7	20160617	13274218	32016172018497	Merchandise & supplies	Music & video	NA	5558102117	\$70.00
8	20160617	13274220	32016172018498	Merchandise & supplies	Music & video	NA	5557495061	\$80.00
9	20160617	13274230	32016172018499	Business services	Health care services	NA	5559321864	\$90.00
10	20160617	13274236	32016172018500	Restaurant	Restaurant	NA	5551869731	\$100.00
11	20160617	13274239	32016172018501	Merchandise & supplies	Groceries	NA	5554914804	\$90.00
12	20160617	13274240	32016172018502	Business services	Health care services	NA	5552682932	\$80.00
13	20160617	13274241	32016172018503	Business services	Health care services	NA	5551606583	\$70.00
14	20160617	13274242	32016172018504	Fees & adjustments	Fees & adjustments	NA	5558979830	\$60.00
15	20160617	13274249	32016172018505	Business services	Contracting services	NA	5558855254	\$50.00
16	20160617	13274251	32016172018506	Entertainment	Sports events	NA	5557903363	\$40.00
17	20160617	13274258	32016172018507	Travel	Lodging	NA	5554231047	\$30.00
18	20160617	13274266	32016172018508	Other	Miscellaneous	NA	5551339259	\$20.00
19	20160617	13274274	32016172018509	Business services	Health care services	NA	5555502637	\$10.00
20	20160617	13274282	32016172018510	Merchandise & supplies	Groceries	NA	5551386371	\$20.00
21	20160617	13274287	32016172018511	Entertainment	Other entertainment	NA	5551508827	\$30.00
22	20160617	13274296	32016172018512	Merchandise & supplies	Department stores	NA	5554661994	\$40.00
23	20160617	13274302	32016172018513	Other	Utilities	NA	5554438826	\$50.00
24	20160617	13274306	32016172018514	Business services	Health care services	NA	5559722356	\$60.00
25	20160617	13274310	32016172018515	Merchandise & supplies	Appliance stores	NA	5553447554	\$70.00





- Order plus selection
  - Random
  - Stratified
  - Serpentine
  - Linear trend
  - Periodicity
- **Generally, list order other than random is a useful property in combination with systematic selection**
  - **Implicit stratification: gains in precision**



## Unit 5

- 1 Systematic selection
  - 2 Intervals with fractions
  - 3 List order
  - 4 **Uncertainty estimation**
- Unit 1: Sampling as a research tool
  - Unit 2: Mere randomization
  - Unit 3: Saving money
  - Unit 4: Being more efficient
  - **Unit 5: Simplifying sampling**
    - 1 Systematic selection
    - 2 Intervals with fractions
    - 3 List order
    - 4 **Uncertainty estimation**
  - Unit 6: Some extensions & applications

