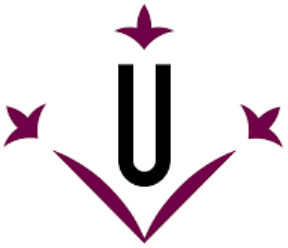

Universitat de Lleida

Preferential attachment

Report

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Universitat de Lleida
Escola Politècnica Superior
Grau en Enginyeria Informàtica
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1 Introduction

Using an anonymous and unlinkable ring signature-based forum, the way of choosing the K set of the signature ring can affect the privacy of users. In this report is demonstrated that preferential attachment makes users more anonymous and invulnerable from knowing its messages.

The simulation forum program was made in `python3` and its execution was made using 200 people and Zipf distribution to determine the number of messages of each member. Also, was parameterized the maximum number of messages from an author, in order to know which member can have worst privacy. In all cases of s from 1.3 to 2.0, the number of messages determined from the distribution is 305.

2 s: 13

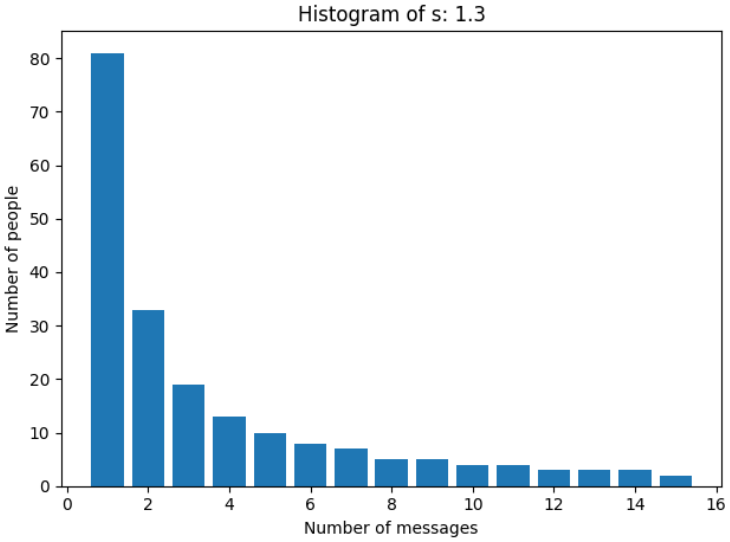

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Figure 1: Histogram of Zipf Distribution using s=13

	S:1.3		
3	10.4	2.34	1.4533
4	13.4	2.86	1.7533
5	17.7	3.76	1.9533
6	21.4	4.34	2.2133
7	24.8	4.82	2.4933
8	28.7	5.62	2.72
9	32.5	6.36	2.9267
10	36.7	7.16	3.2533
11	40.8	7.96	3.3867
12	44.9	8.84	3.5467
	27.13	5.406	2.57

	S:1.3		
3	10.7	2.1	1.98
4	16.9	3.82	2.4
5	24.0	4.6	2.4867
6	28.1	5.22	2.4733
7	35.1	6.06	3.5
8	41.5	7.04	2.8733
9	43.4	6.24	4.5
10	53.4	7.42	3.66
11	58.2	8.64	3.64
12	63.6	8.54	4.0933
	37.49	5.968	3.1607

3 s: 14

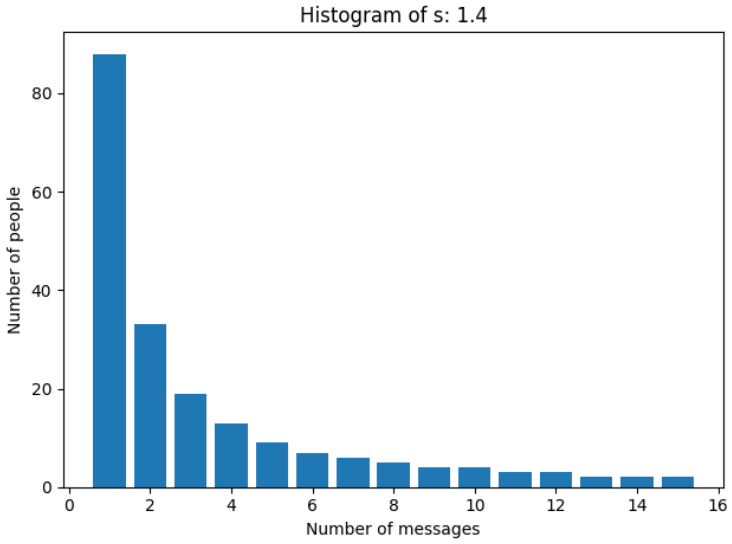

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Figure 2: Histogram of Zipf Distribution using s=14

	S:1.4		
3	10.0	2.24	1.4133
4	13.4	2.8	1.6333
5	17.5	3.72	1.8067
6	20.1	4.1	2.1467
7	24.4	4.74	2.2867
8	27.7	5.36	2.5467
9	31.2	6.04	2.7133
10	33.1	6.32	3.0933
11	38.0	7.12	3.1467
12	42.7	7.88	3.3867
	25.81	5.032	2.4173

	S:1.4		
3	10.6	2.12	2.24
4	17.7	3.48	2.4
5	25.6	3.66	2.8733
6	33.0	4.3	2.88
7	38.1	5.66	3.4667
8	45.1	6.1	3.28
9	46.5	7.18	4.1267
10	53.2	8.6	3.88
11	56.6	8.32	4.28
12	72.8	7.26	3.58
	39.92	5.668	3.3007

4 s: 15

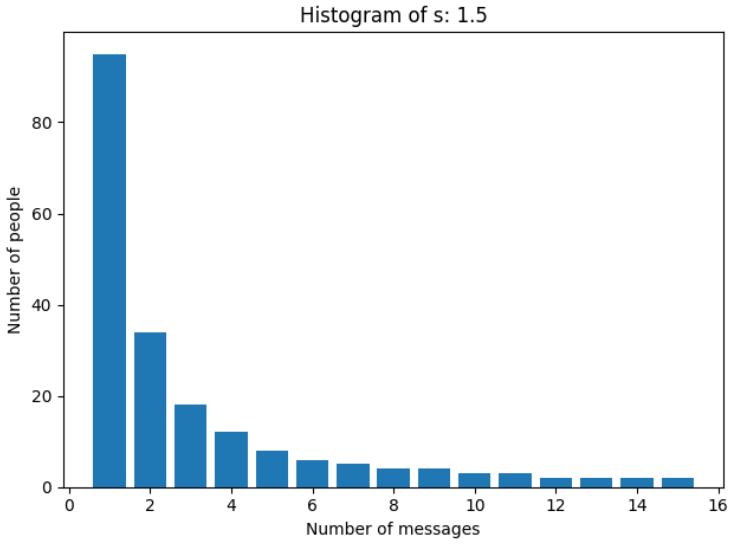

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Figure 3: Histogram of Zipf Distribution using s=15

	S:1.5		
3	8.9	2.12	1.3933
4	12.2	2.5	1.62
5	16.0	3.16	1.7733
6	18.6	3.9	2.0733
7	22.2	4.58	2.1867
8	25.3	4.98	2.38
9	30.0	5.66	2.5867
10	31.9	6.36	2.88
11	34.9	7.02	3.0333
12	39.4	7.14	3.2867
	23.94	4.742	2.3213

S:1.5			
3	7.9	2.26	1.98
4	12.3	3.6	2.12
5	18.6	4.0	3.0867
6	22.0	4.96	2.7
7	30.0	5.9	3.6667
8	34.4	6.74	3.4333
9	40.2	6.06	3.7133
10	39.4	6.4	4.5467
11	49.2	7.2	4.0933
12	49.0	7.78	3.6867
	30.3	5.49	3.3027

5 s: 16

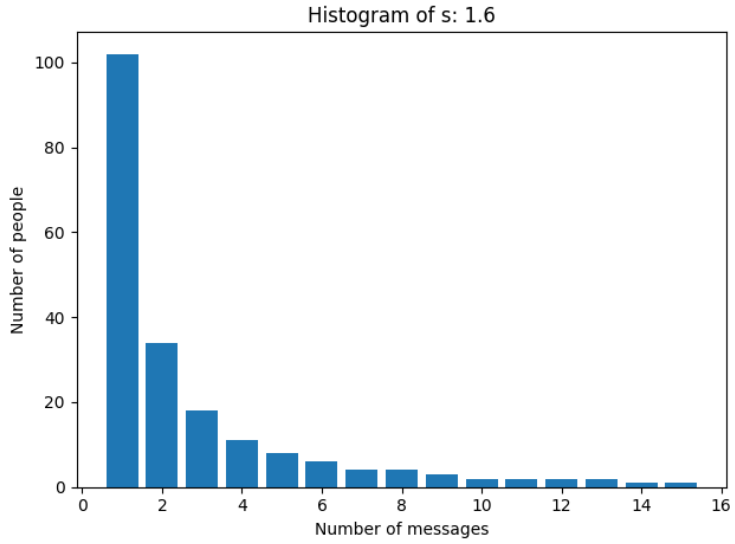

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Figure 4: Histogram of Zipf Distribution using s=16

S:1.6			
3	8.3	2.22	1.3067
4	11.4	2.94	1.5667
5	15.3	3.28	1.7
6	17.8	3.92	1.9133
7	20.1	4.56	2.0333
8	23.0	5.1	2.24
9	27.3	5.44	2.4667
10	29.8	6.12	2.52
11	31.6	6.68	2.7133
12	35.0	7.18	2.9267
	21.96	4.744	2.1387

	S:1.6		
3	7.1	2.2	1.8333
4	13.3	3.16	2.2
5	17.4	3.44	2.2867
6	19.6	4.84	2.7
7	25.6	5.32	2.9133
8	28.9	6.74	3.8
9	35.5	6.2	4.0933
10	37.5	6.26	4.1267
11	44.4	8.82	3.64
12	43.1	6.14	4.12
	27.24	5.312	3.1713

6 s: 17

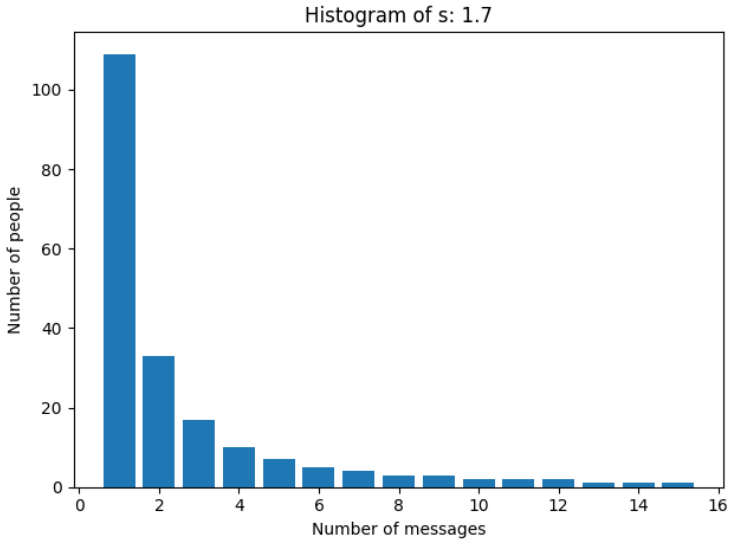

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Figure 5: Histogram of Zipf Distribution using s=17

	S:1.7		
3	7.4	1.98	1.2933
4	11.3	2.54	1.52
5	15.0	3.12	1.6533
6	17.4	3.52	1.86
7	19.4	4.04	2.0067
8	22.3	4.4	2.14
9	25.5	5.24	2.3133
10	27.8	5.9	2.4667
11	30.2	6.6	2.6333
12	34.0	6.94	2.8267
	21.03	4.428	2.0713

	S:1.7		
3	9.6	1.9	1.78
4	13.3	2.96	2.2733
5	18.1	3.58	2.52
6	22.3	3.62	2.7933
7	26.4	4.26	2.8867
8	32.7	4.76	3.2333
9	36.0	6.52	4.08
10	41.0	5.18	3.8133
11	43.6	7.5	4.02
12	47.6	6.32	3.34
	29.06	4.66	3.074

7 s: 18

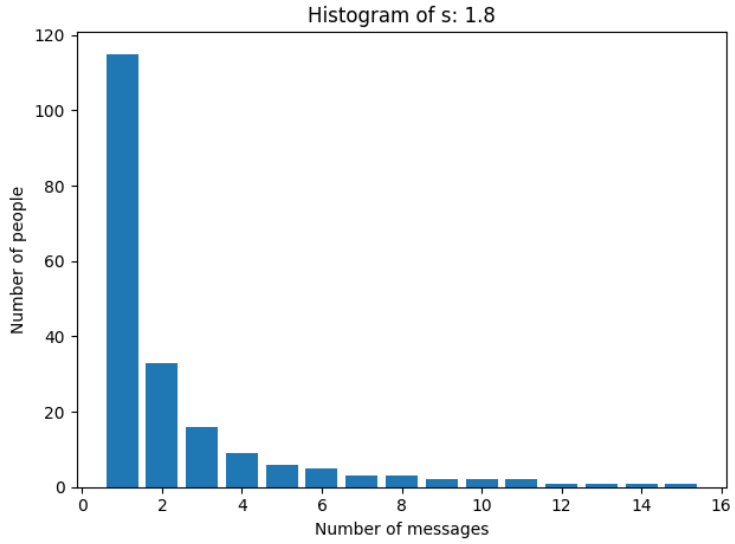

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Figure 6: Histogram of Zipf Distribution using s=18

	S:1.8		
3	7.0	2.1	1.2267
4	10.1	2.42	1.4933
5	13.9	3.02	1.6133
6	15.5	3.42	1.8467
7	19.7	4.04	1.88
8	21.0	4.58	2.0
9	23.9	4.86	2.2733
10	26.2	5.42	2.44
11	28.4	5.96	2.5667
12	31.9	6.38	2.6933
	19.76	4.22	2.0033

	S:1.8		
3	7.3	2.68	1.8667
4	10.9	3.54	2.2933
5	15.1	2.9	2.2267
6	19.8	3.96	2.9067
7	23.9	3.04	2.96
8	27.8	4.16	3.6733
9	32.5	4.22	4.36
10	35.9	5.3	3.6267
11	35.3	4.56	3.8267
12	42.2	5.44	3.8733
	25.07	3.98	3.1613

8 s: 19

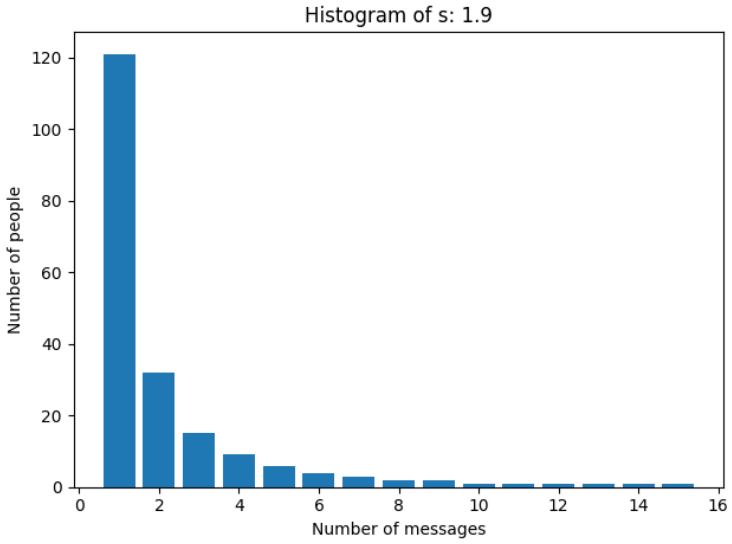

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Figure 7: Histogram of Zipf Distribution using s=19

	S:1.9		
3	6.0	1.72	1.2533
4	9.5	2.22	1.42
5	13.5	2.52	1.6
6	15.3	2.8	1.7933
7	17.9	3.28	1.8333
8	19.7	3.64	1.9933
9	22.1	3.82	2.1533
10	24.4	4.46	2.26
11	26.5	4.82	2.48
12	30.0	5.48	2.6
	18.49	3.476	1.9387

	S:1.9		
3	6.9	3.04	1.9067
4	10.6	2.82	2.26
5	14.0	3.26	2.0533
6	18.1	5.44	2.3933
7	21.1	4.42	2.7533
8	24.4	6.64	3.1067
9	28.5	4.42	3.4
10	30.9	5.24	5.0533
11	39.2	6.96	4.2467
12	37.7	7.38	4.5933
	23.14	4.962	3.1767

9 s: 20

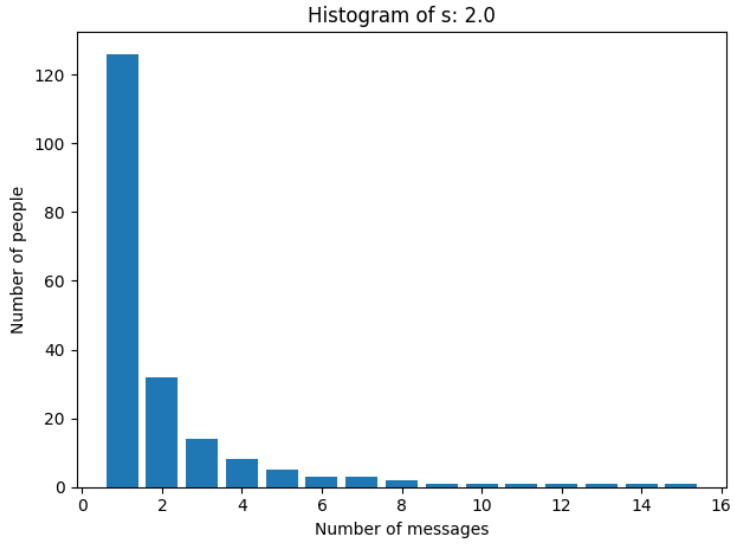

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Figure 8: Histogram of Zipf Distribution using s=20

	S:2.0		
3	6.4	2.0	1.2467
4	9.0	2.4	1.3933
5	12.9	2.8	1.6333
6	14.4	3.36	1.7133
7	17.5	3.84	1.8133
8	19.0	4.3	1.9933
9	21.6	4.8	2.04
10	23.2	5.24	2.2533
11	24.4	5.56	2.3533
12	28.4	5.88	2.5733
	17.68	4.018	1.9013

	S:2.0		
3	6.5	2.62	1.66
4	9.5	3.1	2.1533
5	14.2	3.84	2.3933
6	17.5	4.42	2.74
7	20.7	5.42	2.7733
8	23.6	3.58	3.14
9	26.8	6.34	3.7667
10	29.2	4.94	3.14
11	32.0	5.5	3.7133
12	36.0	7.9	4.4933
	21.6	4.766	2.9973