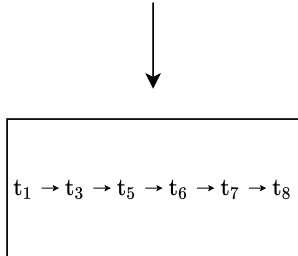
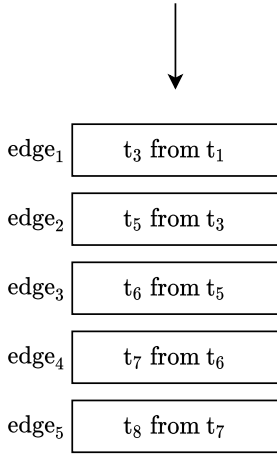


# Hadith Movement: Tracking Streams of Hadith Across the Cities over Time

# 1 Hadith to Edges

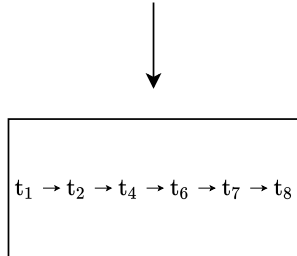
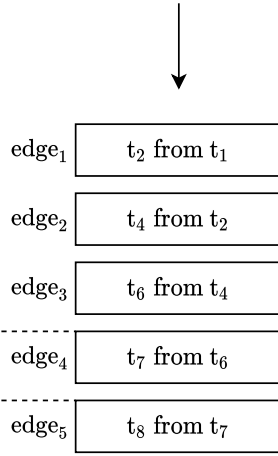
## Hadith – 1

Bukhārī (id:  $t_8$ ) writes: ‘Ubaydallāh b. Musā (id:  $t_7$ ) narrated to us, saying: Hanzala b. Abī Sufyān (id:  $t_6$ ) reported to us about ‘Ikrima b. Khālīd (id:  $t_5$ ): about Ibn ‘Umar (id:  $t_3$ ), may God be pleased with them both, that he said that the Prophet (id:  $t_1$ ), peace and blessings be upon him, said: “Islam is built on five things: testifying that there is no god but God and that Muhammad is the messenger of God, establishing daily prayer, giving the charity tax, the pilgrimage, and fasting in Ramaḍān.”



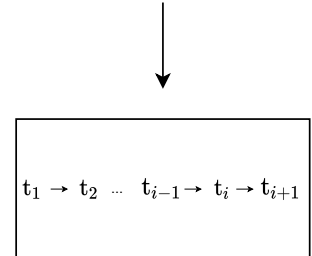
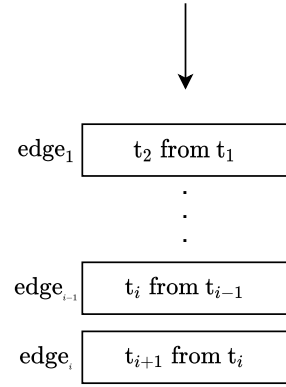
## Hadith – 2

Bukhārī (id:  $t_8$ ) writes: Ubaydallāh b. Musā (id:  $t_7$ ) narrated to us, saying: Hanzala b. Abī Sufyān (id:  $t_6$ ) reported to us about al-Qāsim b. Muḥammad (id:  $t_4$ ) about ‘Ā’isha (id:  $t_2$ ), may God be pleased with her, that she said: “the Prophet (id:  $t_1$ ), peace and blessings be upon him, used to pray thirteen cycles during the night, including the witr and dawn prayers.”

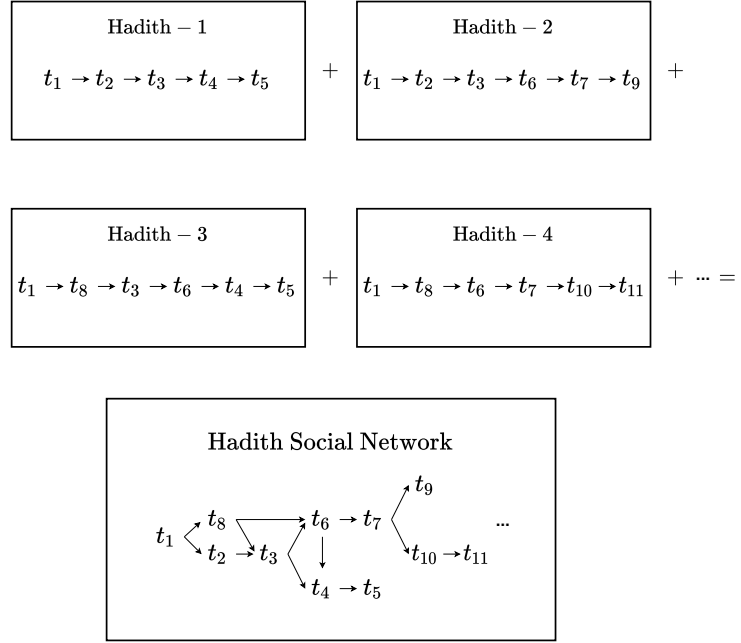


## Hadith – $\alpha$

[final transmitter (id:  $t_{i+1}$ )] [mode of transmission] [intermediary transmitter (id:  $t_i$ )] [mode of transmission] [intermediary transmitter (id:  $t_{i-1}$ )] ... [intermediary transmitter (id:  $t_2$ )] [mode of transmission] [initial transmitter (id:  $t_1$ )] [matn (content)]

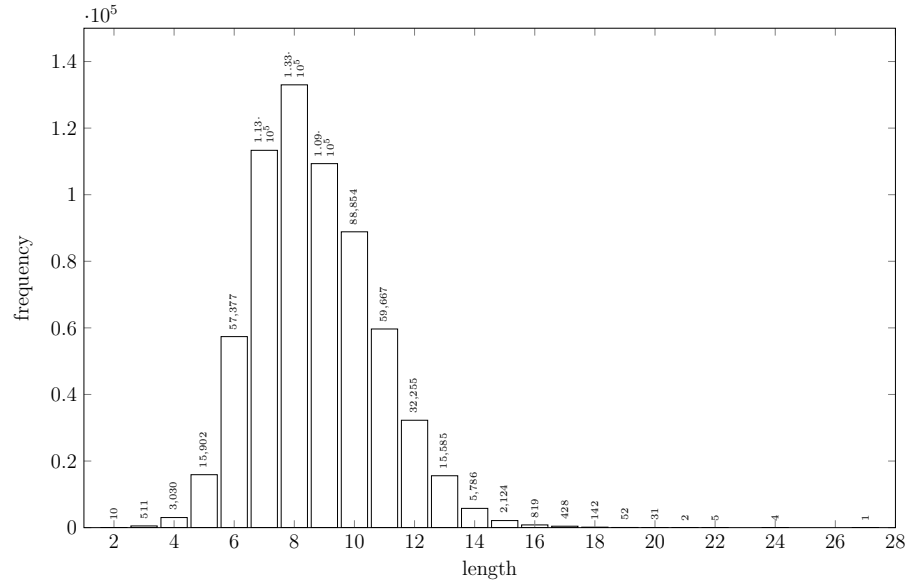


## 2 Edges to HSN

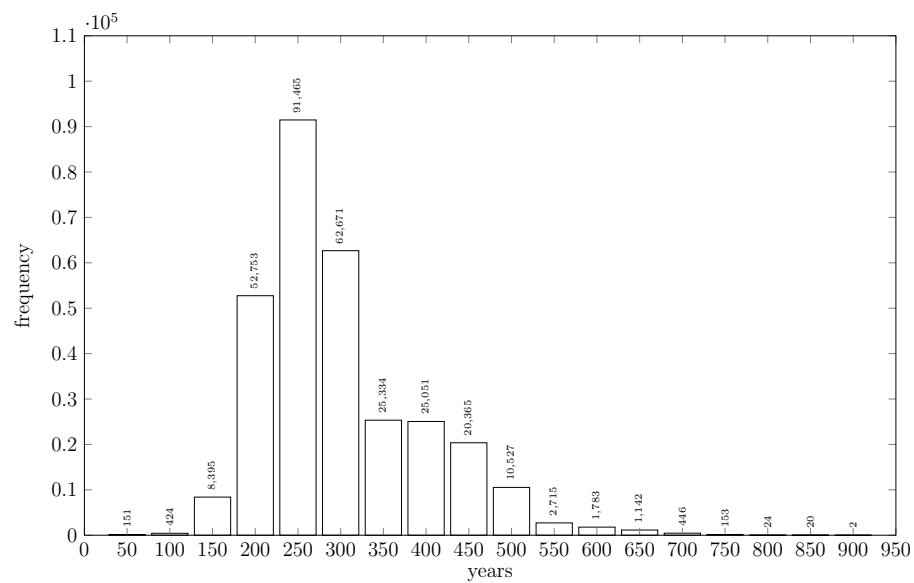


### 3 Travel Analysis

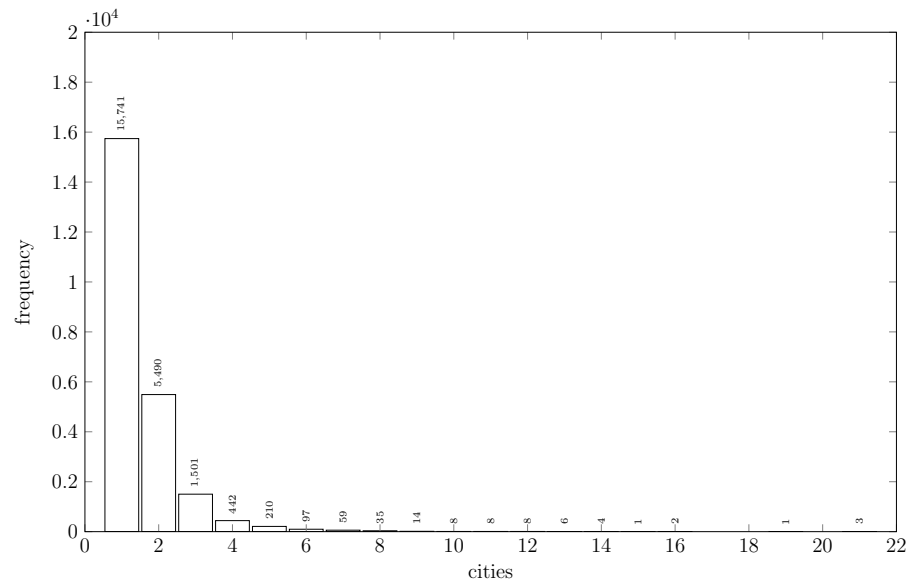
#### 3.1 Number of Transmitters in each Isnad



### 3.2 Travel Duration of each Hadith



### 3.3 Number of Cities in each Transmitter's Biography



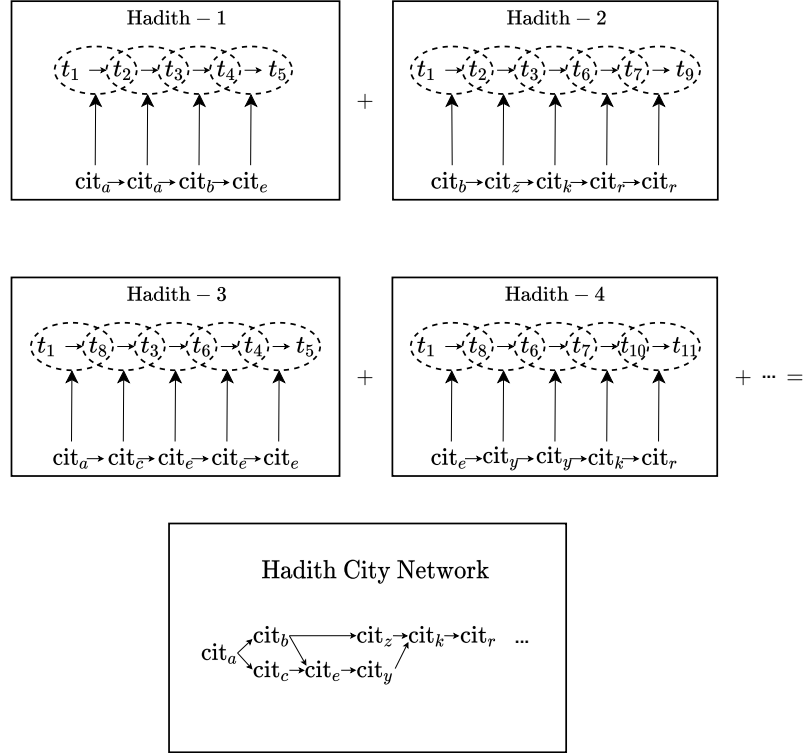
## 4 City Analysis

city	biography count
bghdad	4,966
dmshq	3,533
bsrh	3,136
kwfh	2,802
almdynh	2,209
msr	1,744
sham	1,191
asbhan	1,144
nysabwr	1,068
mkh	965
mrw	586
alhjaz	506
alry	503
wast	476
hms	471
khrasan	429
jrjan	339
qzwyn	273
hrah	267
hlb	257
al'eraq	244
bkhara	237
hran	206
almwsl	205
alymn	201

city	transmission count
bsrh	187,293
bghdad	173,657
kwfh	158,428
almdynh	131,375
msr	65,989
dmshq	54,425
nysabwr	43,123
mkh	37,688
asbhan	23,323
wst	17,686
mrw	15,774
hms	14,429
sn'ea'	13,376
alry	7,911
qrtbh	6,806
hran	5,439
bghlan	4,302
hrah	4,140
alrqh	3,067
jrjan	2,921
aljzyrh	2,757
almwsl	2,542
bkhara	2,503
nsa	2,135
aylh	1,916

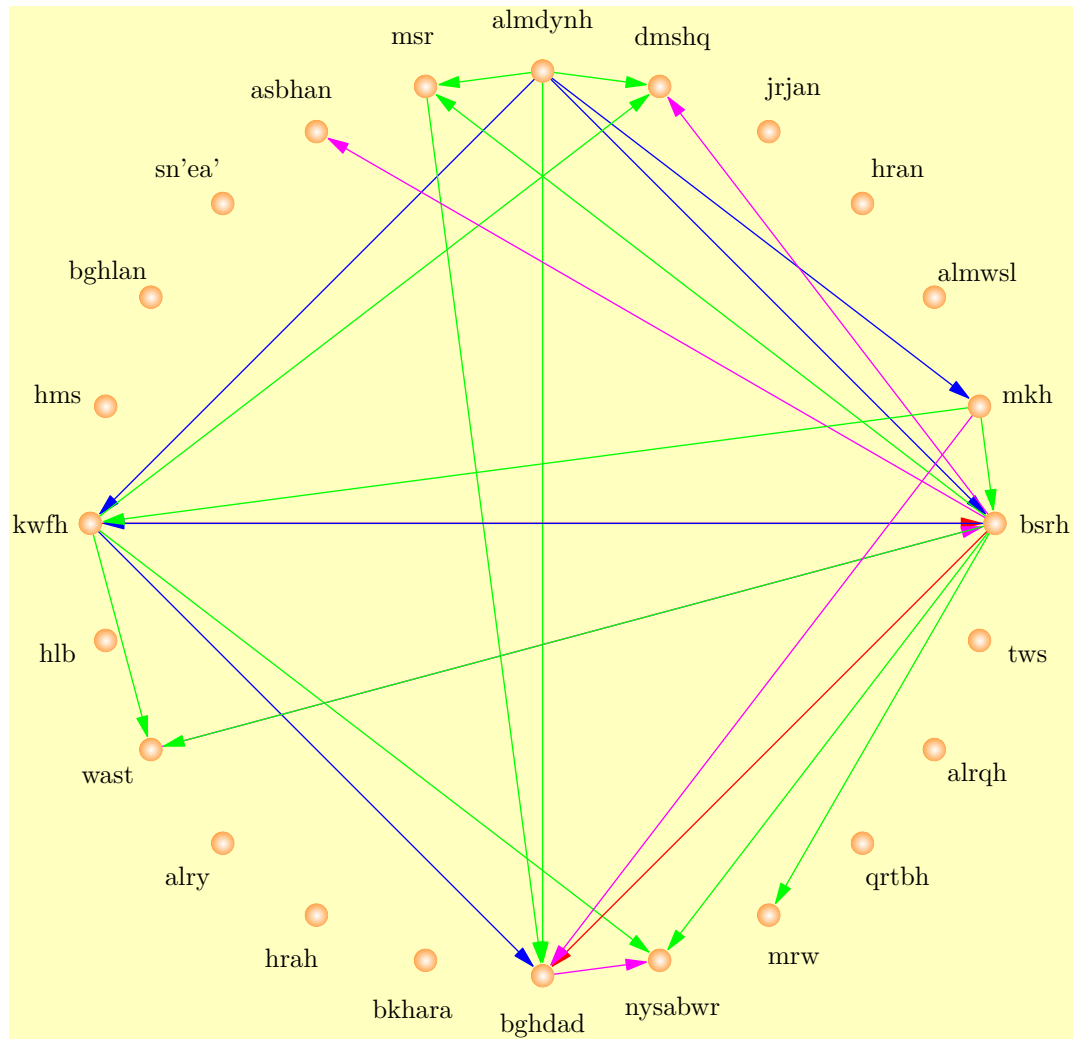
city	transmission count
bsrh	187,293
bghdad	173,657
kwfh	158,428
almdynh	131,375
msr	65,989
dmshq	54,425
nysabwr	43,123
mkh	37,688
asbhan	23,323
wast	17,686
mrw	15,774
hms	14,429
sn'ea'	13,376
alry	7,911
qrtbh	6,806
hran	5,439
bghlan	4,302
hrah	4,140
alrqh	3,067
jrjan	2,921
almwsl	2,542
bkhara	2,503
hlb	1,878
twsl	1,323

## 5 Edges to City Network

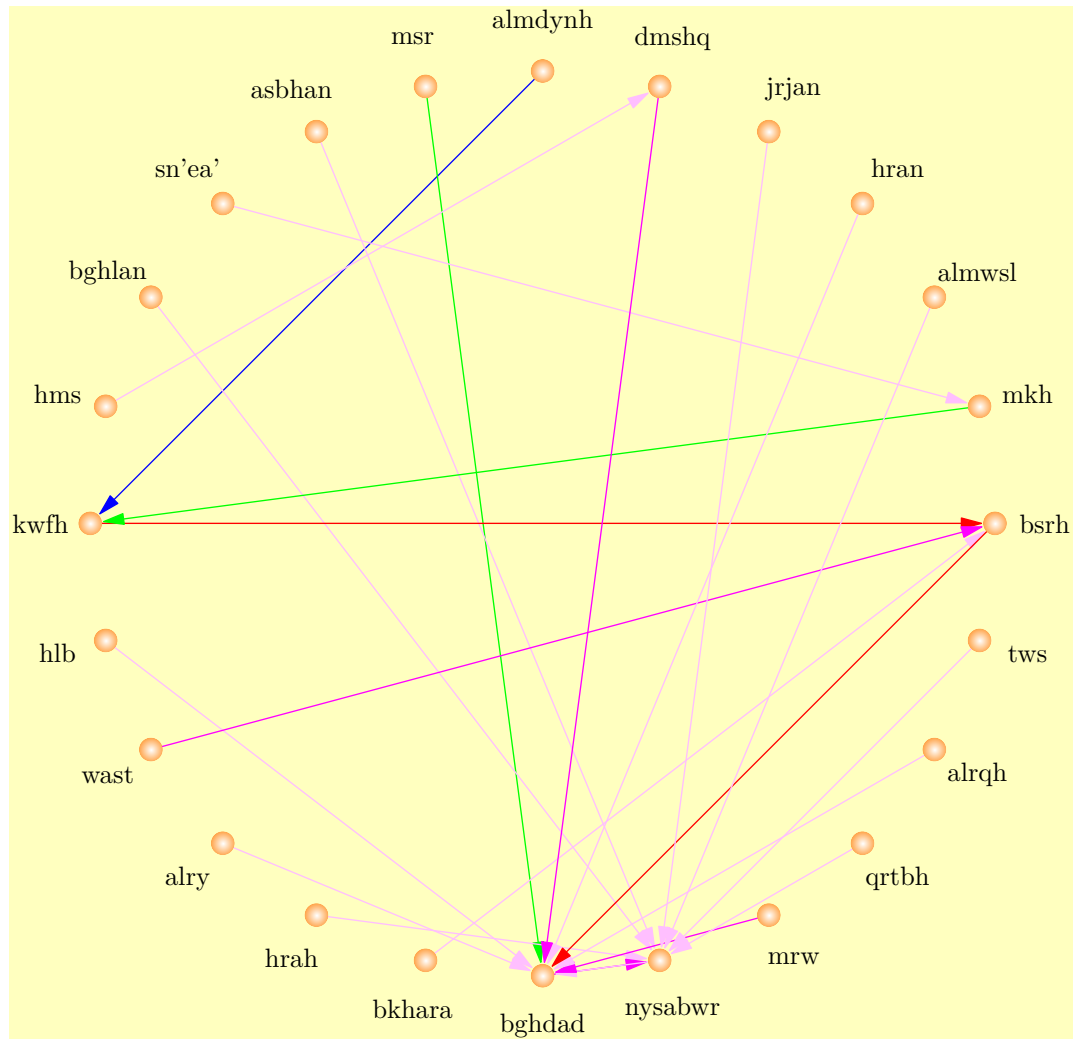




## 6 Top 24 Outgoing Paths in Entire City Network (nodes as cities)



## 7 Top Outgoing Path from Each City in City Network (nodes as cities)



## 8 Top 10 Paths in City Network (nodes as cities) in Each 30 Year Partitioned Network

−11 — 30			30 — 60			60 — 90		
From	To	Count	From	To	Count	From	To	Count
almdynh	almdynh	3798	almdynh	almdynh	16053	almdynh	almdynh	14248
almdynh	kwfh	2274	almdynh	kwfh	2157	kwfh	kwfh	3950
almdynh	dmshq	264	almdynh	mkh	1746	almdynh	mkh	2565
almdynh	mkh	208	almdynh	bsrh	1164	almdynh	kwfh	1885
almdynh	hms	201	kwfh	kwfh	1011	almdynh	bsrh	1061
almdynh	bsrh	38	almdynh	dmshq	423	bsrh	bsrh	1024
kwfh	kwfh	37	almdynh	hms	394	mkh	mkh	1010
almdynh	msr	27	almdynh	msr	373	almdynh	hms	733
almdynh	alhjaz	27	almdynh	mrw	178	mkh	kwfh	538
almdynh	alrbdh	22	mkh	mkh	68	almdynh	dmshq	286

90 — 120			120 — 150			150 — 180		
From	To	Count	From	To	Count	From	To	Count
almdynh	almdynh	16002	kwfh	kwfh	20461	bsrh	bsrh	28105
bsrh	bsrh	7733	almdynh	almdynh	16475	kwfh	kwfh	20811
kwfh	kwfh	7145	bsrh	bsrh	16309	almdynh	almdynh	14733
almdynh	mkh	2724	kwfh	bsrh	3860	kwfh	bsrh	10413
mkh	mkh	2666	almdynh	kwfh	3765	msr	msr	6306
almdynh	bsrh	2449	mkh	kwfh	3145	almdynh	kwfh	3500
almdynh	dmshq	1771	mkh	mkh	2971	almdynh	bsrh	2945
almdynh	kwfh	1209	almdynh	bsrh	2874	almdynh	bghdad	2838
mkh	kwfh	777	mkh	sn'ea'	1918	wast	bsrh	2832
kwfh	bsrh	754	msr	msr	1847	bsrh	kwfh	2374

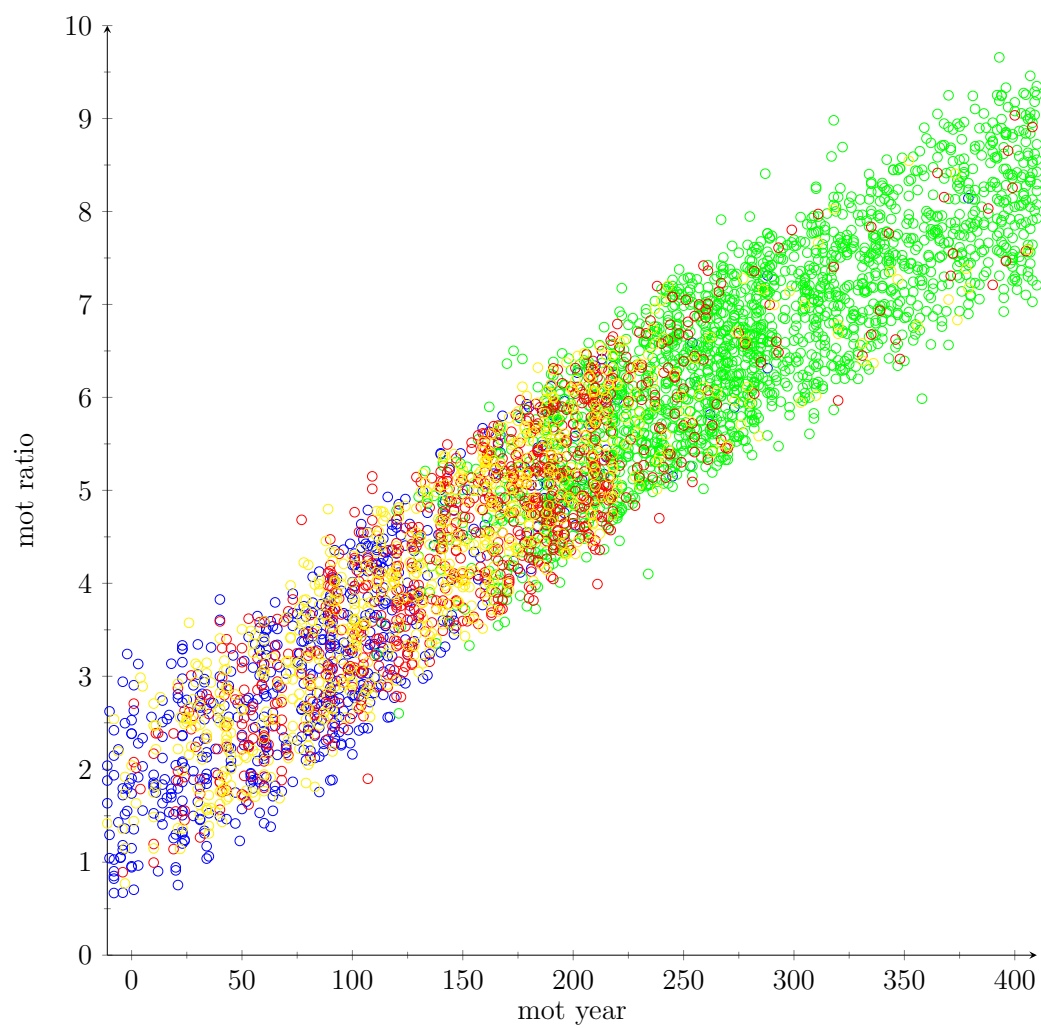
  

180 — 210			210 — 240			240 — 270		
From	To	Count	From	To	Count	From	To	Count
kwfh	kwfh	30458	bsrh	bsrh	35677	bsrh	bsrh	15641
bsrh	bsrh	30108	kwfh	kwfh	25904	msr	msr	10576
bsrh	bghdad	7452	bghdad	bghdad	9959	kwfh	kwfh	9345
msr	msr	7120	bsrh	bghdad	9312	bghdad	bghdad	5970
sn'ea'	sn'ea'	5862	msr	msr	6688	bsrh	bghdad	4436
kwfh	bsrh	5563	kwfh	bghdad	5841	kwfh	bghdad	3425
kwfh	bghdad	4947	kwfh	dmshq	5584	bsrh	msr	3147
almdynh	msr	4676	dmshq	dmshq	3481	bsrh	nysabwr	2403
almdynh	bsrh	4365	almdynh	almdynh	3401	dmshq	dmshq	2082
almdynh	almdynh	4035	kwfh	bsrh	3167	mkh	mkh	1466

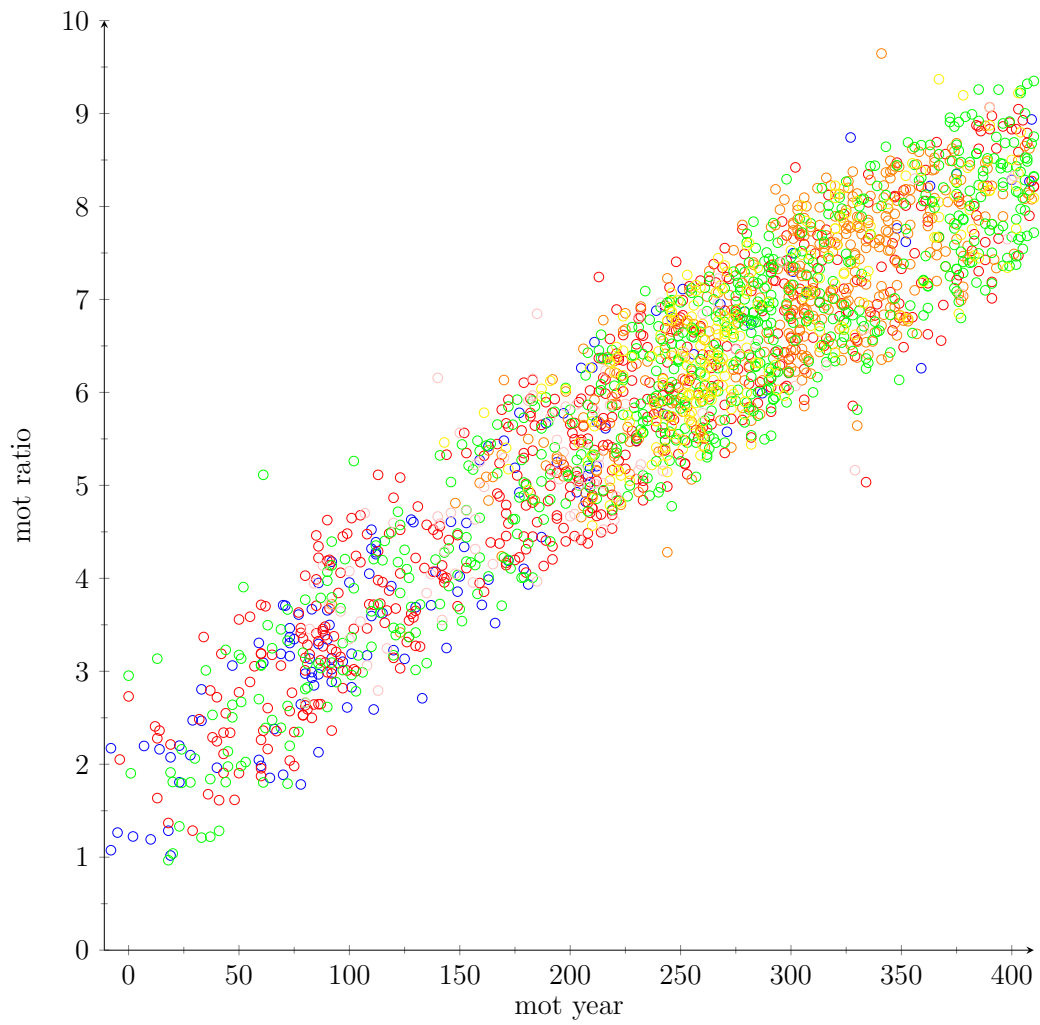
  

270 — 300			300 — 330			330 — 360		
From	To	Count	From	To	Count	From	To	Count
bghdad	bghdad	8837	bghdad	bghdad	9271	bghdad	bghdad	10419
bsrh	bsrh	7288	bsrh	bghdad	2206	nysabwr	nysabwr	2537
bsrh	bghdad	6910	kwfh	bghdad	1993	dmshq	dmshq	1488
kwfh	bghdad	2968	nysabwr	nysabwr	1825	bghdad	asbhan	1458
dmshq	dmshq	2429	bsrh	bsrh	1582	dmshq	asbhan	1327
msr	msr	2408	msr	msr	1089	msr	asbhan	1179
mrw	bghdad	1666	bsrh	nysabwr	1086	bghdad	nysabwr	1097
mkh	bghdad	1395	bghdad	almwsl	1056	msr	bghdad	1061
bsrh	mkh	1333	dmshq	dmshq	1025	asbhan	asbhan	1020
nysabwr	nysabwr	1296	bghdad	bsrh	922	msr	nysabwr	941

## 9 Network Flow (main cities)



## 10 Network Flow (supporting cities)



## 11 Centrality Metrics

		Centrality Metrics			
		PageRank		Betweenness	
From	To	City	Value	City	Value
-11	30	almdynh	0.0878	almdynh	192.567
30	60	mkh	0.065	almdynh	595.083
60	90	almdynh	0.0568	almdynh	901.914
90	120	msr	0.0579	almdynh	1212.98
120	150	kwh	0.0441	bsrh	1767.34
150	180	kwh	0.0426	bsrh	2570.18
180	210	bghdad	0.0416	kwh	4151.41
210	240	bghdad	0.0466	bghdad	4248.02
240	270	bghdad	0.0479	bghdad	5816.34
270	300	bghdad	0.0464	bghdad	6749.24
300	330	bghdad	0.0686	bghdad	9006.63
330	360	bghdad	0.0654	bghdad	8021.82
360	390	bghdad	0.0639	bghdad	6961.39
390	420	bghdad	0.0622	bghdad	4431.1
420	450	dmsdq	0.0744	bghdad	3401.95
450	480	bghdad	0.068	bghdad	2772.14
480	510	bghdad	0.0843	bghdad	1651.06

## 12 Degree Histogram of City Network

