COMS4721 Machine Learning for Data Science Homework 4

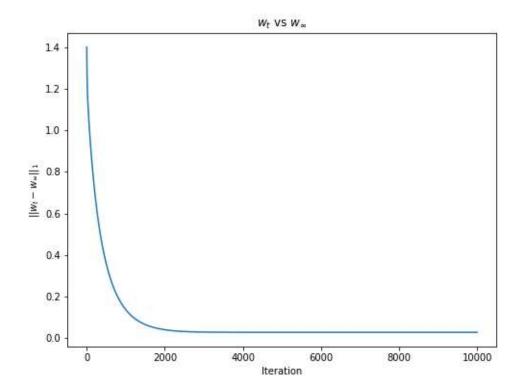
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Problem 1

(a) The top 25 team names and W_t at different step:

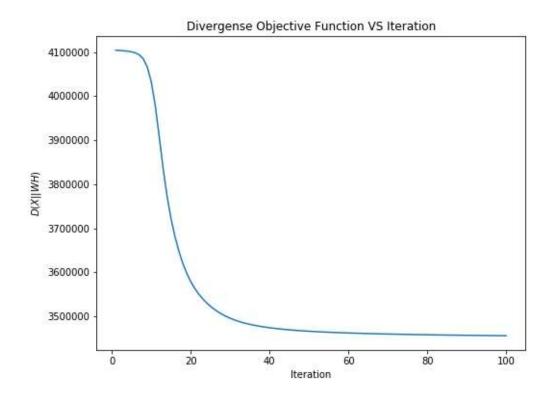
Rank	T = 10	$\mathbf{W_{10}}$	T = 100	W_{100} $T = 1000$		$\mathbf{W_{1000}}$	T = 10000	\mathbf{W}_{10000}
1	Mary Hardin-Baylor	0.01764	Mary Hardin-Baylor	0.060847	Clemson	0.097376	Clemson	0.103882
2	Clemson	0.014032	Clemson	0.048803	Alabama	0.053666	Alabama	0.057223
3	Mount Union	0.012249	Alabama	0.027211	Georgia	0.023191	Georgia	0.024716
4	Morningside	0.011157	Mount Union	0.021396	Ohio State	0.022592	Ohio State	0.024055
5	North Dakota St	0.010944	St John's MN	0.014651	Notre Dame	0.022337	Notre Dame	0.023797
6	Valdosta St	0.010343	Morningside	0.013446	Oklahoma	0.019113	Oklahoma	0.020352
7	St John's MN	0.009912	Valdosta St	0.012792	Texas A&M	0.016575	Texas A&M	0.017669
8	Alabama	0.009898	North Dakota St	0.012502	LSU	0.015152	LSU	0.016144
9	UW-Whitewater	0.009683	Georgia	0.011877	Florida	0.015051	Florida	0.016036
10	Ferris St	Johns Hopkins 0.009448 Notre Dame	Ohio State	0.011871	North Dakota St	0.014736	North Dakota St	0.015302
11	Johns Hopkins		Notre Dame	0.011583	Kentucky	0.014335	Kentucky	0.015276
12	Brockport St		UW-Whitewater	0.011481	Texas	0.013914	Texas	0.014817
13	Princeton	0.006811	Ferris St	0.011187	Michigan	0.013782	Michigan	0.014679
14	Minn St-Mankato	0.006735	Oklahoma	0.010029	Syracuse	0.013223	Syracuse	0.014091
15	Benedictine KS	0.006551	Johns Hopkins	0.00989	Central Florida	0.012441	Central Florida	0.013244
16	Kansas Wesleyan	0.005917	Texas A&M	0.008446	Mary Hardin-Baylor	0.011884	Washington	0.012022
17	Ohio State	0.005844	LSU	0.0078	Washington	0.011317	Washington St	0.011908
18	Marian IN	0.005659	Florida	0.007782	Washington St	0.011222	Penn State	0.010773
19	Bethel MN 0.005655 Kentucky	Kentucky	0.007376	Penn State	0.010118	Auburn	0.010624	
20	Muhlenberg	0.00554	Texas	0.007278	Auburn	0.009977	Missouri	0.010359
21	Tarleton St	0.005476	Michigan	0.007193	Missouri	0.009722	Iowa	0.010259
22	Ouachita Baptist	0.005418	Syracuse	0.006816	Iowa	0.009648	Northwestern	0.009784
23	Georgia	0.005409	Central Florida	0.006538	Northwestern	0.009192	West Virginia	0.009764
24	Notre Dame	0.005299	Washington St	0.00638	West Virginia	0.009174	Fresno St	0.009452
25	Notre Dame OH	0.005249	Washington	0.006269	Fresno St	0.008901	South Carolina	0.008896

(b) Plot the difference between W_t and stationary W:



Problem 2

(a) Plot the objective as a function of iteration:



(b) The 5 by 5 table:

concentive 0.041928 report 0.015755 job 0.029102 question 0.013183 government 0.015723 executive 0.015747 drug 0.015648 worker 0.017675 issue 0.012485 american 0.015961 business 0.015547 cause 0.011441 handle 0.013887 view 0.00818 military 0.013817 sale 0.012891 official 0.010564 keep 0.010671 concern 0.007188 official 0.013817 share 0.012763 agency 0.010044 effice 0.01045 clear 0.006464 war 0.012982 chief 0.011091 percent 0.00785 check 0.0099 believe 0.00629 leader 0.006242 force county chig 0.011091 pertent 0.00718 pay 0.00894 action 0.00629 leader 0.009219 system 0.011091 pertinest 0.01148 bill		•								
business 0.015547 cause 0.01444 handle 0.01887 public 0.008752 states 0.01501 sell 0.015031 test 0.011773 problem 0.018877 view 0.00818 military 0.013847 sale 0.012899 problem 0.010476 employee 0.010552 statement 0.006567 country 0.01311 share 0.012765 agency 0.010004 office 0.001945 clear 0.00644 curr 0.012982 chief 0.011304 treatment 0.007254 apply 0.00914 action 0.00624 force 0.009219 buy 0.010912 risk 0.007187 pay 0.008845 suspect 0.00624 force 0.009219 computer 0.011873 building 0.024477 care 0.022012 mater 0.00182 lawer 0.02130 system 0.011873 building 0.024477 care 0.022012 water <td>company</td> <td>0.041928</td> <td>report</td> <td>0.015755</td> <td>job</td> <td>0.029102</td> <td>question</td> <td>0.013183</td> <td>government</td> <td>0.015723</td>	company	0.041928	report	0.015755	job	0.029102	question	0.013183	government	0.015723
sell 0.015031 test 0.011773 problem 0.013827 view 0.00818 military 0.013817 sale 0.012931 official 0.010546 keep 0.00671 concern 0.007158 official 0.013171 share 0.012765 agency 0.010040 office 0.01052 statement 0.006567 country 0.013136 chief 0.011609 percent 0.00755 check 0.00999 believe 0.00629 leader 0.009219 buy 0.011912 risk 0.007187 pay 0.008845 suggest 0.006182 international 0.00892 computer 0.01873 building 0.024477 care 0.023268 mile 0.013954 case 0.021508 system 0.012498 city 0.020756 life 0.023268 mile 0.013954 case 0.021508 company 0.011702 project 0.014382 family 0.014841 0.015	executive	0.01772	drug	0.015648	worker	0.017657	issue	0.012485	american	0.015496
sale 0.013931 official 0.010564 keep 0.10671 concern 0.007158 official 0.013131 president 0.012765 agency 0.010004 cffice 0.010152 statement 0.006567 country 0.013136 share 0.011609 percent 0.00785 check 0.0099 believe 0.00629 leader 0.007291 market 0.011304 treatment 0.007254 apply 0.00845 suggest 0.00629 leader 0.009219 computer 0.01813 building 0.024477 care 0.028268 mile 0.013954 case 0.021058 system 0.014498 city 0.020756 life 0.02012 water 0.01832 lawer 0.02033 company 0.011498 build 0.01432 family 0.01845 read 0.00809 court 0.02016 service 0.011102 project 0.01263 child 0.01553 care </td <td>business</td> <td>0.015547</td> <td>cause</td> <td>0.01444</td> <td>handle</td> <td>0.013887</td> <td>public</td> <td>0.008752</td> <td>states</td> <td>0.015261</td>	business	0.015547	cause	0.01444	handle	0.013887	public	0.008752	states	0.015261
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chief 0.011609 percent 0.00785 check 0.00991 believe 0.006291 leader 0.009192 market 0.011304 treatment 0.007254 apply 0.009194 action 0.006242 force 0.009219 buy 0.0116187 building 0.024777 care 0.023268 mile 0.013954 case 0.021508 system 0.012498 city 0.020756 life 0.020012 water 0.012832 lawyer 0.02032 company 0.011648 build 0.014432 family 0.018445 road 0.008098 law 0.016712 service 0.011102 project 0.01263 child 0.015551 town 0.008098 law 0.016716 ster 0.0011010 project 0.01263 child 0.015531 car 0.007619 charge 0.01671 sterbility 0.011102 project 0.01263 child 0.013531 car	president	0.012899	problem	0.010476	employee	0.010552	statement	0.006567	country	0.013136
market 0.011304 treatment 0.007254 apply 0.009194 action 0.006242 force 0.00919 buy 0.010912 risk 0.007187 pay 0.008845 suggest 0.006182 international 0.00803 computer 0.01873 building 0.024477 care 0.023268 mile 0.013954 case 0.021508 system 0.012498 city 0.020756 life 0.020012 water 0.012832 lawyer 0.02032 information 0.011648 build 0.014432 family 0.01845 road 0.008699 court 0.02016 company 0.011102 project 0.01633 child 0.015595 town 0.008089 law 0.016712 service 0.011102 project 0.01263 child 0.015531 car 0.007619 charge 0.01638 site 0.00947 resident 0.011944 woman 0.014581 lain	share	0.012765	agency	0.010004	office	0.010145	clear	0.006464	war	0.012982
buy 0.010912 risk 0.007187 pay 0.008845 suggest 0.006182 international 0.01508 computer 0.01873 building 0.024477 care 0.023268 mile 0.013954 case 0.021508 system 0.012498 city 0.020756 life 0.020012 water 0.012832 lawyer 0.02332 information 0.011448 build 0.014432 family 0.018455 road 0.008699 court 0.020216 company 0.011010 project 0.01263 child 0.015531 car 0.007619 charge 0.016712 service 0.011102 project 0.01263 child 0.015531 car 0.007619 charge 0.016368 technology 0.010716 area 0.011944 woman 0.014581 land 0.007597 judge 0.013323 site 0.00947 resident 0.011931 doctor 0.01361 city	chief	0.011609	percent	0.00785	check	0.0099	believe	0.00629	leader	0.009422
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technology 0.010716 area 0.011944 woman 0.014581 land 0.007597 judge 0.013323 site 0.00947 resident 0.011391 doctor 0.013611 city 0.007337 legal 0.011163 program 0.008498 plan 0.010985 hospital 0.013425 plant 0.007196 file 0.009019 television 0.008399 property 0.010928 medical 0.011573 local 0.006916 investigation 0.00839 study 0.015601 state 0.017534 game 0.03517 win 0.034907 thing 0.012827 research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.02037 final 0.014629 ask 0.00934 decade 0.007631 tax 0.011102 player 0.02001 finish<	company	0.011397	house	0.013389	health	0.015595	town	0.008098	law	0.016712
site 0.00947 resident 0.011391 doctor 0.013611 city 0.007337 legal 0.011613 program 0.008498 space 0.011097 death 0.01333 area 0.007296 trial 0.009561 intermet 0.008498 plan 0.010928 hospital 0.013425 plant 0.007196 file 0.009091 study 0.015601 state 0.017534 game 0.030517 win 0.034907 thing 0.012827 research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.020307 final 0.014629 ask 0.009934 decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory	service	0.011102	project	0.01263	child	0.015531	car	0.007619	charge	0.016368
program 0.008911 space 0.011097 death 0.01353 area 0.007296 trial 0.009501 internet 0.008498 plan 0.010985 hospital 0.013425 plant 0.007196 file 0.009019 television 0.008399 property 0.010928 medical 0.011573 local 0.006916 investigation 0.008399 study 0.015601 state 0.017534 game 0.030517 win 0.034907 thing 0.012827 research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.020514 race 0.015357 feel 0.010344 far 0.00703 tax 0.011802 player 0.02001 finish 0.016633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory </td <td>technology</td> <td>0.010716</td> <td>area</td> <td>0.011944</td> <td>woman</td> <td>0.014581</td> <td>land</td> <td>0.007597</td> <td>judge</td> <td>0.013323</td>	technology	0.010716	area	0.011944	woman	0.014581	land	0.007597	judge	0.013323
internet 0.008498 plan 0.010985 hospital 0.013425 plant 0.007196 file 0.009919 study 0.015601 state 0.017534 game 0.030517 win 0.034907 thing 0.012827 research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.020514 race 0.015357 feel 0.010344 far 0.00703 tax 0.011871 season 0.020307 final 0.014629 ask 0.009934 decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.00876 science 0.006523 propose 0.01044 second 0.01005 third <t< td=""><td>site</td><td>0.00947</td><td>resident</td><td>0.011391</td><td>doctor</td><td>0.013611</td><td>city</td><td>0.007337</td><td>legal</td><td>0.011163</td></t<>	site	0.00947	resident	0.011391	doctor	0.013611	city	0.007337	legal	0.011163
television 0.008399 property 0.010928 medical 0.011573 local 0.006916 investigation 0.008939 study 0.015601 state 0.017534 game 0.030517 win 0.034907 thing 0.012827 research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.020314 race 0.015357 feel 0.010344 far 0.00703 tax 0.011871 season 0.020307 final 0.014629 ask 0.009934 decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.008676 science 0.006523 propose 0.01044 second 0.010005 third	program	0.008911	space	0.011097	death	0.01353	area	0.007296	trial	0.009561
study 0.015601 state 0.017534 game 0.030517 win 0.034907 thing 0.012827 research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.020514 race 0.015357 feel 0.010344 far 0.00703 tax 0.011871 season 0.020307 final 0.014629 ask 0.009934 decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.008676 science 0.006523 propose 0.01044 second 0.010005 third 0.011017 life 0.007298 expert 0.006079 government 0.0097 ball 0.009369 match <t< td=""><td>internet</td><td>0.008498</td><td>plan</td><td>0.010985</td><td>hospital</td><td>0.013425</td><td>plant</td><td>0.007196</td><td>file</td><td>0.009019</td></t<>	internet	0.008498	plan	0.010985	hospital	0.013425	plant	0.007196	file	0.009019
research 0.011136 bill 0.014275 team 0.024239 second 0.01897 tell 0.012377 different 0.007629 proposal 0.012299 play 0.020514 race 0.015357 feel 0.010344 far 0.00703 tax 0.011602 player 0.020307 final 0.014629 ask 0.009934 decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.008676 science 0.006523 propose 0.01044 second 0.010005 third 0.011017 life 0.007634 important 0.00644 plan 0.010221 score 0.009451 round 0.010661 little 0.007584 expert 0.006079 government 0.0097 ball 0.009369 match	television	0.008399	property	0.010928	medical	0.011573	local	0.006916	investigation	0.008939
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far 0.00703 tax 0.011871 season 0.020307 final 0.014629 ask 0.009934 decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009978 professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.008676 science 0.006523 propose 0.01044 second 0.010005 third 0.011017 life 0.007634 important 0.00644 plan 0.010221 score 0.009451 round 0.010661 little 0.007298 expert 0.006079 government 0.0097 ball 0.009369 match 0.010196 lot 0.00684 scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school <td< td=""><td>research</td><td>0.011136</td><td>bill</td><td>0.014275</td><td>team</td><td>0.024239</td><td>second</td><td>0.01897</td><td>tell</td><td>0.012377</td></td<>	research	0.011136	bill	0.014275	team	0.024239	second	0.01897	tell	0.012377
decade 0.006999 budget 0.011602 player 0.02001 finish 0.012633 man 0.009078 professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.008676 science 0.006523 propose 0.01044 second 0.010005 third 0.011017 life 0.007634 important 0.00644 plan 0.010221 score 0.009451 round 0.010661 little 0.007298 expert 0.006079 government 0.0097 ball 0.009369 match 0.010196 lot 0.00684 scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.00991 progra	different	0.007629	proposal	0.012299	play	0.020514	race	0.015357	feel	0.010344
professor 0.006841 law 0.010711 coach 0.010806 victory 0.011802 friend 0.008676 science 0.006523 propose 0.01044 second 0.010005 third 0.011017 life 0.007634 important 0.00644 plan 0.010221 score 0.009451 round 0.010661 little 0.007298 expert 0.006079 government 0.0097 ball 0.009369 match 0.010196 lot 0.00684 scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.009902 program 0.020101 price 0.018599 candidate 0.015401 writer 0.014402 taste 0.007999 <td< td=""><td>far</td><td>0.00703</td><td>tax</td><td>0.011871</td><td>season</td><td>0.020307</td><td>final</td><td>0.014629</td><td>ask</td><td>0.009934</td></td<>	far	0.00703	tax	0.011871	season	0.020307	final	0.014629	ask	0.009934
science 0.006523 propose 0.01044 second 0.010005 third 0.011017 life 0.007634 important 0.00644 plan 0.010221 score 0.009451 round 0.010661 little 0.007298 expert 0.006079 government 0.0097 ball 0.009369 match 0.010196 lot 0.00684 scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.009701 student 0.025052 rate 0.018551 party 0.016126 editor 0.020045 serve 0.009092 program 0.020101 price 0.015999 candidate 0.015401 writer 0.012499 red 0.007845 city	decade	0.006999	budget	0.011602	player	0.02001	finish	0.012633	man	0.009078
important 0.00644 plan 0.010221 score 0.009451 round 0.010661 little 0.007298 expert 0.006079 government 0.0097 ball 0.009369 match 0.010196 lot 0.00684 scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.0099701 student 0.025052 rate 0.018851 party 0.016126 editor 0.020045 serve 0.009092 program 0.020101 price 0.015999 candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.00734 <td< td=""><td>professor</td><td>0.006841</td><td>law</td><td>0.010711</td><td>coach</td><td>0.010806</td><td>victory</td><td>0.011802</td><td>friend</td><td>0.008676</td></td<>	professor	0.006841	law	0.010711	coach	0.010806	victory	0.011802	friend	0.008676
expert 0.006079 government 0.0097 ball 0.009369 match 0.010196 lot 0.00684 scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.009701 student 0.025052 rate 0.018551 party 0.016126 editor 0.020045 serve 0.009902 program 0.020101 price 0.015999 candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.012315 vote 0.013424 story 0.011297 dinner 0.00734 col	science	0.006523	propose	0.01044	second	0.010005	third	0.011017	life	0.007634
scientist 0.005817 pay 0.009409 hit 0.008139 play 0.009986 really 0.006659 campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.009701 student 0.025052 rate 0.018551 party 0.016126 editor 0.020045 serve 0.009902 program 0.020101 price 0.015999 candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.014128 vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243	important	0.00644	plan	0.010221	score	0.009451	round	0.010661	little	0.007298
campaign 0.02225 book 0.030934 food 0.01442 school 0.033402 percent 0.031047 political 0.018878 write 0.025734 restaurant 0.009701 student 0.025052 rate 0.018551 party 0.016126 editor 0.020045 serve 0.009092 program 0.020101 price 0.015999 candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.014128 vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	expert	0.006079	government	0.0097	ball	0.009369	match	0.010196	lot	0.00684
political 0.018878 write 0.025734 restaurant 0.009701 student 0.025052 rate 0.018551 party 0.016126 editor 0.020045 serve 0.009092 program 0.020101 price 0.015999 candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.014128 vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	scientist	0.005817	pay	0.009409	hit	0.008139	play	0.009986	really	0.006659
party 0.016126 editor 0.020045 serve 0.009092 program 0.020101 price 0.015999 candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.014128 vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	campaign	0.02225	book	0.030934	food	0.01442	school	0.033402	percent	0.031047
candidate 0.015401 writer 0.014402 taste 0.007999 education 0.013465 rise 0.015782 election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.014128 vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	political	0.018878	write	0.025734	restaurant	0.009701	student	0.025052	rate	0.018551
election 0.014978 article 0.012499 red 0.007845 city 0.011595 market 0.014128 vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	party	0.016126	editor	0.020045	serve	0.009092	program	0.020101	price	0.015999
vote 0.013424 story 0.011297 dinner 0.00734 college 0.011029 increase 0.012315 leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	candidate	0.015401	writer	0.014402	taste	0.007999	education	0.013465	rise	0.015782
leader 0.012162 page 0.011186 add 0.007243 child 0.010844 economy 0.012284	election	0.014978	article	0.012499	red	0.007845	city	0.011595	market	0.014128
	vote	0.013424	story	0.011297	dinner	0.00734	college	0.011029	increase	0.012315
democratic 0.011108 life 0.010945 eat 0.007219 group 0.010602 low 0.010545	leader	0.012162	page	0.011186	add	0.007243	child	0.010844	economy	0.012284
	democratic	0.011108	life	0.010945	eat	0.007219	group	0.010602	low	0.010545

republican	0.010038	publish	0.010553	fresh	0.007157	class	0.009978	fall	0.009799
voter	0.009252	author	0.010273	pound	0.007047	public	0.009434	economic	0.008937
police	0.031262	music	0.017997	father	0.055373	art	0.016569	deal	0.018718
kill	0.022524	play	0.016259	mother	0.046361	design	0.010671	contract	0.011313
man	0.017109	film	0.013426	son	0.046175	artist	0.010662	sign	0.01122
officer	0.016905	performance	0.01025	mrs	0.043479	collection	0.008902	change	0.009352
arrest	0.011117	audience	0.009915	daughter	0.035955	museum	0.008766	lot	0.009115
fire	0.010394	movie	0.009873	graduate	0.031157	photograph	0.00816	offer	0.009097
official	0.00935	production	0.008149	marry	0.02448	exhibition	0.007584	money	0.008801
attack	0.009268	stage	0.007906	retire	0.019262	color	0.007035	thing	0.00843
death	0.009056	theater	0.007851	receive	0.018626	display	0.00681	big	0.008409
crime	0.00899	dance	0.007594	family	0.018172	image	0.006609	ago	0.00802