

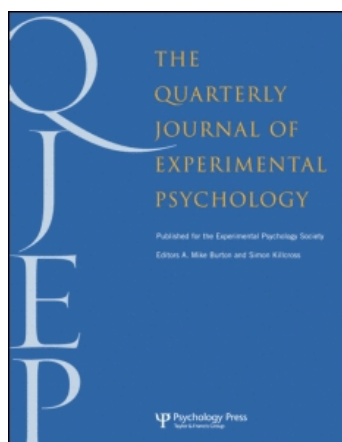
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### Bigram frequency counts and anagram lists

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# BIGRAM FREQUENCY COUNTS AND ANAGRAM LISTS

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In the first part of this paper bigram frequency counts are given for the first letter-pairs, last letter-pairs and "other" letter-pairs of words of more than three letters. A short discussion of the use and relevance of such tables is given. In the second part, lists of anagram-pairs of words are given for words of length three or more letters, together with approximate percentages of occurrence of such "anagrammatical" words in the English language.

## Introduction

This paper contains two distinct sections. In the first section, tables of bigram frequencies are given, for the first letter-pairs, last letter-pairs and other letter-pairs of each word. In the second section, lists of paired anagrams are given for words of three or more letters, together with rough figures for the percentage of "anagrammatical" words in English in use.

## Part I

### *Bigram frequency tables*

Before discussing the design and preparation of these tables it is necessary to examine their function. Primarily, such tables are hypothesized as representing frequency distributions of bigrams in use which the word recognition systems in the brain use for maximally efficient processing. In its simplest form such a system may reject a bigram - bz - but accept - az -. In more complex forms it would presumably lower letter recognition thresholds for frequent bigrams and raise them for less frequent bigrams. For such a system to operate efficiently, however, certain fairly simple distinctions should be made. First, the bigram frequencies of first letter-pairs in words will differ from last letter-pairs, which will differ from other letter pairs. It would seem fairly sensible, therefore, for such a word recognition system to distinguish bigram position at least in this rough and ready (and simple) way. Second, the bigram frequencies of shorter words are markedly different from longer words, especially in frequencies of initial and terminal bigrams. Again, it is suggested that a word recognition system would operate more efficiently if it made a simple length discrimination, say short (three or fewer letters) and long (four or more letters).

As most bigram frequency tables do not make such distinctions they possess certain unrealistic bigram frequencies. Thus Pratt (1939), finds a medium bigram frequency (nine per 1000) for the bigram - ay - made up mainly of three letter words such as say, day, may, way, hay, etc. Their frequency in words of four letters and longer is calculated below to be 2.6 per thousand. Similarly Pratt finds a frequency of 132 per thousand for the bigram - he - whereas for longer words it was found to be only 25.3 per thousand. This distortion by shorter words may extend even further, so that for Newman and Gerstman (1952), and for Baddeley, Conrad and Thomson (1960) the letters - a - and - i - are suggested as extremely frequent terminators of words. This is, of course, bias imposed by the fact that the words I and a are extremely frequent words.

If word recognition systems were to operate using such distorted frequencies they would be operating extremely inefficiently. It would seem desirable, therefore, to present tables which reflected the distinctions made above, so that the frequencies given reflect those which may be used in word recognition. One paper which has done this is that of Mayzner and Tresselt (1965). They gave bigram frequencies for each word length (three to seven letters) and for each position within each word. While this information may be extremely useful for most anagram studies, which generally use shorter words, the tables do not reflect occurrence in general print as most texts contain a considerable number of longer words. The tables presented below are therefore for all words of four letters and longer. Considering letter position, it was felt that to distinguish all letter positions within each word would have made the tables unnecessarily complex and difficult to use. It has been found (Bruner and O'Dowd, 1958; Marchbanks and Levin, 1965; Williams, Blumberg and Williams, 1970) that the first and last letters of a word are particularly significant in word recognition, and therefore, considering this and the fact that bigram frequencies differ markedly for first, last and other letter-pairs, as discussed above, distinctions are made only upon whether the bigram is the first letter-pair, last letter-pair or any other letter-pair. The large differences between such bigrams may be seen in the tables below.

### *Preparation*

The words used for the preparation of the bigram frequency tables were taken from the Thorndike-Lorge word count (Thorndike and Lorge, 1944). All words from section I were used except (1) those containing punctuation, (2) those containing upper case letters and (3) those with fewer than four letters. The elimination of words containing punctuation makes the tables simpler and is likely to inconvenience only cryptographers. The decision to eliminate proper nouns was more difficult, but it was felt that first, word recognition systems are unlikely to take account of such proper nouns and second, that the frequency of use of such proper nouns is likely to be substantially different between the U.S.A. and Great Britain. With these exceptions, approximately 16,500 words were used in the analysis.

In order to represent bigram frequency in use it is, of course, necessary to adjust the bigram count from the words themselves according to the varying frequency of those words. Thus for words of frequency 35-36 per million, the count was multiplied by 35.5 to give an approximate figure of the frequency per million. Certain difficulties occur with this treatment for higher and lower frequency categories. Thus for frequency category two to three per million, many more words would be in the lower half of the frequency category than the upper half. With consideration of the relative numbers of words in surrounding categories an estimate was made of the mean frequency within each category and the count multiplied by this figure. Thus for the two to three per million category, the count was multiplied by 2.43. Using a similar procedure and a little guesswork the figure used for the 50 to 100 category was 73.7. Such an estimate was thought to be unrealistic for the over 100 per million category, however. For words in this category a separate bigram frequency count was gathered from the frequency scores given in the separate Lorge count, and the table adjusted to compare with the general count, with which it was then summed. The figures were finally adjusted to give frequency per thousand.

Mention must be made of the fact that words of lower frequency than one per million were not used in this preparation. There were three major reasons for this:

- (1) Convenience;
- (2) Effect—including such low frequency words would have little effect on the tables;
- (3) Relevance—it is possible that a word recognition system has developed which reflects only bigram frequencies of more common words. Less frequent words may be stored and analysed in some other way.

The final tables represent, therefore, bigram frequencies per 1000 words, of words occurring at least once per million in normal usage and of more than three letters. Table I

TABLE I

*Bigram frequency counts—frequency of occurrence per 1000 words*

Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs	Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs
ab	4.2		3.5	cu	0.7		1.9
ac	2.2		6.5	cy	0.1	0.6	
ad	1.4	0.9	2.7	da	1.1		1.2
af	2.9		0.4	dd			1.3
ag	2.6		2.4	de	5.4	2.4	9.0
ai			9.0	df			0.1
aj			0.2	dg			0.6
ak		0.3	1.3	dh			0.1
al	4.3	6.3	6.9	di	4.4		3.9
am	0.9	0.5	3.0	dj			0.1
an	3.8	3.1	15.2	dl			1.4
ap	1.6	0.1	4.1	dm			0.5
ar	2.0	1.6	17.8	dn			0.3
as	1.1	0.1	6.7	do	1.1		1.5
at	0.8	2.0	17.4	dr	1.7		1.8
au	0.5	0.1	3.6	ds		0.1	0.4
av	0.3		2.5	dt			0.1
aw	0.4	0.1	0.3	du	0.5		1.7
ay		1.2	1.4	dv			0.5
az			0.3	dw	0.1		0.1
ba	1.1		1.4	dy	0.1	1.5	
bb			0.3	ea	0.9		17.4
be	10.0	0.3	2.1	eb			0.4
bi	0.4		1.1	ec	0.2		10.1
bj			0.4	ed	0.2	3.2	1.9
bl	1.5		6.0	ee		1.5	5.0
bm			0.1	ef	0.3	0.5	3.6
bo	1.0		4.8	eg			2.8
br	3.6		0.5	eh			0.9
bs			0.7	ei	0.6		2.5
bt		0.1	0.2	ej			0.1
bu	2.6		0.4	ek		0.1	0.1
by		0.1		el	0.7	1.4	9.4
ca	3.4		4.7	em	0.7	0.7	6.0
cc			1.8	en	2.7	8.6	19.9
ce	0.9	11.2	4.2	eo			1.7
ch	5.7	7.2	2.3	ep	0.1	0.4	3.3
ci	0.5		3.5	eq	0.2		0.5
ck		1.9	1.2	er	0.1	33.3	27.6
cl	3.2		1.7	es	0.5	1.6	16.2
co	17.7	0.1	3.5	et	0.1	2.1	9.0
cq			0.1	eu			0.2
cr	1.9		2.0	ev	3.1		5.6
cs		0.1		ew		0.3	0.7
ct		2.9	5.2	ex	3.8	0.1	0.1

TABLE I—*contd*

Bigram	First letter- pairs	Last letter- pairs	Other letter- pairs	Bigram	First letter- pairs	Last letter- pairs	Other letter- pairs
ey		1.6	0.2	id	0.1	0.6	3.9
ez			0.1	ie		0.1	5.7
				if			2.4
fa	3.5		0.7	ig	0.1		10.4
fe	0.6	0.1	2.5	ik			0.4
ff		0.3	2.9	il	0.2	1.9	9.9
fi	4.6		2.4	im	1.7	0.3	3.3
fl	1.5		0.5	in	6.4	5.0	32.2
fo	4.3		3.1	io		0.1	40.5
fr	2.7		0.3	ip		0.5	0.8
ft		0.3	3.4	iq			0.1
fu	0.8		1.9	ir	0.1	0.8	5.2
fy		0.4		is	0.2	0.2	10.1
				it	0.3	1.6	14.2
ga	0.9		4.2	iu			0.2
gd			0.1	iv			4.5
ge	0.8	3.6	2.9	ix			0.3
gg			0.4	iz			1.3
gh		3.8	11.1				
gi	0.6		1.7	ja	0.1		
gl	1.0		0.7	je	0.1		0.6
gm			0.1	jo	0.6		0.4
gn		0.4	0.6	ju	0.4		0.2
go	2.3		0.4				
gr	4.2		1.4	ka			0.1
gs			0.1	ke	0.1	1.0	2.0
gt		1.1	0.3	kf			0.1
gu	0.6		1.3	ki	0.4		0.6
gy		0.3		kl			0.5
				kn	1.6		0.3
ha	2.4		5.7	ks			0.1
hb			0.2	kw			0.1
hd			0.1	ky		0.1	
he	3.0	0.3	22.0				
hf			0.2	la	2.2	0.1	8.5
hi	1.3		18.7	lb			0.1
hl			0.4	lc			0.2
hm			0.2	ld		9.8	2.3
hn			0.1	le	3.4	15.0	7.3
ho	3.4		11.0	lf		2.6	0.1
hr			3.6	lg			0.1
ht		9.6	0.9	li	5.2		7.6
hu	2.0		0.4	lk		0.1	
hw			0.2	ll		2.6	6.6
hy	0.1	0.3	0.2	lm			0.9
				ln			0.1
ia		0.1	3.0	lo	0.9		8.5
ib			2.1	lp			0.2
ic		1.9	12.2	lr			0.6

TABLE I—*contd*

Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs	Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs
ls			0.3	oa			1.1
lt		1.1	1.1	ob	0.7		1.4
lu	0.3		2.1	oc	0.5		2.5
lv			0.7	od		1.4	1.9
lw			1.2	oe		0.1	0.1
ly		13.3	0.1	of	1.6	0.1	0.5
				og			1.4
				oh			0.1
ma	3.9	0.1	5.3	oi			3.8
mb		0.1	2.5	oj			0.1
me	2.0	2.2	9.5	ok		0.2	0.7
mf			0.2	ol		0.8	5.6
mi	3.3		5.0	om		0.7	10.4
ml			0.1	on		13.3	16.2
mm			1.8	oo			4.6
mn		0.2	0.1	op	0.8	0.4	2.7
mo	6.2		3.7	or	1.1	3.1	15.0
mp		0.2	4.6	os			7.8
ms			1.1	ot	2.5	0.8	6.6
mu	0.6		0.5	ou	0.6		37.7
my	0.9	0.2		ov	0.3		2.8
				ow		2.7	4.1
				ox			0.1
na	1.4		4.2	oy		0.3	0.4
nb			0.1				
nc			8.7	pa	3.2		2.5
nd		9.5	8.2	pe	4.2	0.4	6.8
ne	3.3	2.8	7.0	ph	0.4	0.2	0.7
nf			1.3	pi	1.0		1.8
ng		18.2	3.5	pl	3.1		4.8
nh			0.2	pm			0.1
ni	1.3		6.9	po	3.7		4.0
nj			0.3	pp			4.4
nk		2.3	0.5	pr	9.0		2.1
nl			1.3	ps		0.7	0.2
nm			0.4	pt		0.8	0.8
nn			2.2	pu	1.3		0.5
no	2.1		4.4	py		0.7	
np			0.1				
nq			0.3	qu	2.2		1.7
nr			0.1				
ns			6.4	ra	1.4	0.1	12.0
nt		11.8	12.5	rb		0.1	0.4
nu	0.6		2.9	rc			2.5
nv			1.0	rd		3.0	2.2
nw			0.2	re	11.6	14.5	19.7
nx			0.1	rf			0.7
ny		0.9	1.1	rg			1.8
nz			0.1				

TABLE I—*contd*

Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs	Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs
rh	0.1		0.8	tt			8.4
ri	1.8		13.3	tu	0.2		5.4
rk		0.3	0.4	tw	0.6		0.7
rl			1.4	ty		5.4	0.1
rm		0.7	1.5	ua			2.3
rn		2.0	3.0	ub			2.0
ro	0.5		15.3	uc			2.6
rp		0.1	0.9	ud		0.3	2.2
rr			4.4	ue		2.3	1.7
rs		0.2	6.5	uf			0.6
rt		3.6	6.0	ug			7.2
ru	0.2		2.1	ui			3.2
rv			1.9	ul		1.3	12.0
rw			0.4	um		0.2	2.5
ry		8.2	1.0	un	5.0	0.1	9.0
sa	1.3		2.0	uo			0.3
sb			0.6	up	0.2	0.4	1.8
sc	2.1		1.5	ur		2.0	11.0
se	4.0	14.2	6.4	us	0.3	2.5	8.8
sf			0.4	ut	0.2	4.8	4.1
sg			0.1	ux			0.1
sh	4.6	2.0	1.2	uz			0.1
si	2.0		5.8	va	1.0		1.3
sk	0.3		0.1	ve	0.5	5.8	12.5
sl	0.7		0.8	vi	1.0		2.7
sm	2.0	0.2	0.3	vo	0.9		1.0
sn	0.2		0.1	wa	1.8		3.0
so	3.9		2.6	wd		0.1	0.1
sp	2.4	0.1	2.0	we	0.7		3.9
sq	0.3		0.1	wf			0.1
ss		6.5	4.2	wh	9.7		0.4
st	10.1	7.8	9.2	wi	2.5		0.8
su	4.6		1.8	wl		0.1	0.2
sw	0.8		0.8	wn		1.4	0.1
sy	0.4	0.2		wo	7.9		0.3
ta	1.5		9.5	wr	0.7		
tc			1.4	ws			0.1
te	1.4	7.5	16.9	xa			0.4
tf			0.3	xc			0.8
th	18.8	3.4	16.7	xe			0.3
ti	0.4		20.1	xh			0.1
tl			6.2	xi			0.3
tm			0.4	xp			1.8
tn			0.3	xt			0.6
to	3.0	0.2	5.5	xu			0.1
tr	4.1		6.5				
ts			0.5				

TABLE I—*contd*

Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs	Bigram	First letter-pairs	Last letter-pairs	Other letter-pairs
ya			0.3	yr			0.1
yb			0.1	ys		1.1	1.4
yc			0.1	yt			1.7
ye	0.1		0.2	yw			0.2
yh			0.1				
yi	0.1		0.1	za			0.2
yl			0.2	ze		1.3	0.1
ym			0.3	zi			0.1
yn			0.1	zl			0.1
yo	1.6		0.3	zy		0.1	
yp			0.1	zz			0.1

gives the frequencies for the bigrams which occur on average more than once per 20 000 words, in either first, last or other positions. Table II gives those bigrams which occur less than once per 20 000 but did occur somewhere in the corpus.

TABLE II

*Bigrams occurring at least once in the whole corpus, but not as frequently as once per 20,000*

#### First letter-pair

ae ai aq az by eg ej eu ey gh gn gy ic io iv ka kh ko ll ly ny oa od oi ol om  
on os ow ox oy pn ps py ty ub ud ul um ur vu ze zi zo

#### Last letter-pair

ab ac ae af ag ah ax ba bi bo ca da do ea eb eg eo eu fa gi gm go ha hm ho  
ib if ig ik ix jo ka ki ks li lm lo lp ls mo na nc ni no ns nx ob og oo os ou  
ox pa po rf rh rl ro sa sc si sk so ta ti ts tt tu tz ub ug ux uy we wk ws wy  
xt xy ye yl ym yo yp yr yx za

#### Other letter-pairs

aa ae ah ao ax bc bd bg bh bk bn bv bw by cd cn cs cy db dc dk dp dq dy  
fb fh fn fs gb gf gp gw gy gz hc hg hh hp hq hs ih iw ja kb kc kd kg kh kk  
km ko kp kr kt ku ky lh lk mc md mh mr mt mr mw my oq oz pb pf pk pn  
pw py rj rq sd sj sr sv sy tb td tg tp tz uk uq uu uv vu wb wc wg wk wm  
wp wr wt wu ww xy xo xq xs xy yd yf yg yz zo zu zv

## Part II

### *Anagram lists of words length three or more letters*

Many experiments in psychology have revolved around the use of anagrams (Hunter, 1959; Klibanoff, 1973; Mayzner and Tresselt, 1958; Solso, Topper and Macey, 1973; and many others). To facilitate the selection of anagrams, lists are presented below of pairs of words for which each is an anagram of the other, for words of length three to 12 letters.



## TABLE III

*Anagrams*

## 11 letters (2)

procreation incorporate

incorporate procreation

## 10 letters (10)

admonition domination  
 antagonist stagnation  
 coordinate decoration  
 decoration coordinate

domination admonition  
 impression permission  
 indiscreet iridescent  
 iridescent indiscreet

permission impression  
 stagnation antagonist

## 9 letters (24)

attentive tentative  
 broadside sideboard  
 catalogue coagulate  
 housework workhouse  
 howsoever whosoever  
 introduce reduction  
 limestone milestone  
 milestone limestone

ownership shipowner  
 patroness transpose  
 procedure reproduce  
 reduction introduce  
 reproduce procedure  
 shipowner ownership  
 sideboard broadside  
 statement testament

strapping trappings  
 tentative attentive  
 testament statement  
 transpose patroness  
 trappings strapping  
 whosoever howsoever  
 workhouse housework

## 8 letters (48)

adjuster readjust  
 adroitly idolatry  
 altitude latitude  
 aspirant partisan  
 backward drawback  
 conserve converse  
 converse conserve  
 creation reaction  
 creditor director  
 director creditor  
 drainage gardenia  
 drawback backward  
 emphasis misshape  
 estrange sergeant  
 gardenia drainage  
 idolatry adroitly

insecure sinecure  
 integral triangle  
 lameness nameless  
 latitude altitude  
 minutely untimely  
 misshape emphasis  
 mutilate ultimate  
 nameless lameness  
 overturn turnover  
 parental paternal  
 partisan aspirant  
 paternal parental  
 perverse preserve  
 preserve perverse  
 reaction creation  
 readjust adjuster

recourse resource  
 research searcher  
 resource recourse  
 restrain strainer  
 retrench trencher  
 royalist solitary  
 searcher research  
 sergeant estrange  
 sinecure insecure  
 solitary royalist  
 strainer restrain  
 trencher retrench  
 triangle integral  
 turnover overturn  
 ultimate mutilate  
 untimely minutely

## 7 letters (145)

abridge brigade  
 admirer married  
 article recital  
 assuage sausage  
 auction caution  
 avenger engrave  
 bedroom boredom  
 bizarre brazier  
 blister bristle  
 bolster lobster

boredom bedroom  
 brazier bizarre  
 brigade abridge  
 bristle blister  
 builder rebuild  
 carving craving  
 caution auction  
 certify rectify  
 citadel dialect  
 clipper cripple

conical laconic  
 coroner crooner  
 counter recount  
 craving carving  
 cripple clipper  
 crooner coroner  
 cruelty cutlery  
 cutlery cruelty  
 dashing shading  
 dealing leading

## 7 letter words—contd.

decimal	medical	martial	marital	reunite	retinue
	declaim	medical	decimal	reverse	reserve
declaim	decimal		declaim	sausage	assuage
	medical	miracle	reclaim	saviour	various
density	destiny	mundane	unnamed	sceptre	respect
derange	grandee	neither	therein		spectre
destiny	density	nowhere	whereon	seaside	disease
dialect	citadel	obtrude	redoubt	senator	treason
discern	rescind	outlook	lookout	serpent	present
disease	seaside	outside	tedious	settler	trestle
dresser	redress	painter	pertain	shading	dashing
earnest	eastern	percale	replace	silence	license
earthen	hearten	perfect	prefect	spectre	respect
eastern	earnest	pertain	painter		sceptre
engrave	avenger	planter	replant	supreme	presume
enlarge	general	platter	prattle	swelter	wrestle
fighter	freight	pointer	protein	tedious	outside
fluster	restful	prattle	platter	terrace	retrace
forward	froward	prefect	perfect	theatre	thereat
freight	fighter	present	serpent	thereat	theatre
froward	forward	presume	supreme	therein	neither
gallery	largely	printer	reprint	thicken	kitchen
general	enlarge	protein	pointer	treason	senator
grained	reading	pursuer	usurper	trestle	settler
grandam	grandma	reading	grained	tribune	turbine
grandee	derange	rebuild	builder	turbine	tribune
grandma	grandam	recital	article	undergo	guerdon
guerdon	undergo	reclaim	miracle	unnamed	mundane
hearten	earthen	recount	counter	untried	intrude
holster	hostler	rectify	certify	usurper	pursuer
hostler	holster	redoubt	obtrude	various	saviour
however	whoever	redress	dresser	weather	whereat
intrude	untried	replace	percale		wreathe
kitchen	thicken	replant	planter	whereat	weather
laconic	conical	reprint	printer		wreathe
largely	gallery	rescind	discern	whereon	nowhere
leading	dealing	reserve	reverse	whoever	however
license	silence	respect	sceptre	wreathe	weather
lobster	bolster		spectre		whereat
lookout	outlook	restful	fluster	wrestle	swelter
marital	martial	retinue	reunite		
married	admirer	retrace	terrace		

## 6 letters (286)

aboard	abroad	armpit	impart	barley	barely
abroad	aboard	artist	strait	battle	tablet
allure	laurel	ascent	stance	beater	rebate
anchor	archon	ashore	hoarse	bridal	ribald
animal	manila	asleep	elapse	buffer	rebuff
anoint	nation		please	bustle	subtle
antler	learnt	aspire	praise	caller	recall
	rental	astute	statue		cellar
archon	anchor	barely	barley	cannot	canton

## 6 letter words—contd.

canter	recant	filter	trifle	listen	silent
	nectar	finger	fringe		tinsel
	trance	flower	fowler		enlist
canton	cannot	fondle	enfold	livery	verily
carter	crater	forest	foster	loiter	toiler
cavern	craven	former	reform	lovely	volley
cellar	caller	foster	forest	lubber	rubble
	recall	fowler	flower	lumber	rumble
censer	screen	framer	farmer	lustre	ulster
center	centre	fringe	finger		result
	recent	gander	danger		rustle
centre	center		garden	madden	demand
	recent	garden	danger	maiden	median
certes	secret		gander	manila	animal
corona	raccoon	garner	ranger	mantel	mental
corset	escort	garret	garter		lament
	sector	garter	garret		mantle
course	source	gifted	fidget	mantle	mental
crater	carter	ginger	nigger		mantel
craven	cavern	girdle	glider		lament
credit	direct	glider	girdle	marble	ramble
dagger	ragged	grudge	rugged	marine	remain
dandle	landed	halter	lather	marker	remark
danger	garden	hatred	dearth	master	stream
	gander		thread	median	maiden
dawdle	waddle	hatter	threat	mental	mantel
dealer	leader	hawser	washer		lament
dearth	thread	heartly	earthy		mantle
	hatred	heater	reheat	meteor	remote
decree	recede	height	eighth	minuet	minute
demand	madden	hoarse	ashore	minute	minuet
desire	reside	holdup	uphold	nation	anoint
detail	dilate	hornet	throne	nebula	unable
diaper	repaid	ignore	region	nectar	trance
dilate	detail	impart	armpit		recant
direct	credit	impure	umpire		canter
drawer	reward	indent	intend	nester	resent
	warder	inroad	ordain	neuter	tenure
earthy	heartly	insult	sunlit	nigger	ginger
eighth	height	intend	indent	opener	reopen
elapse	asleep	itself	stifle	option	potion
	please	lament	mantel	ordain	inroad
enfold	fondle		mantle	ordeal	reload
enlist	tinsel		mental	outlay	layout
	listen	landed	dandle	paltry	partly
	silent	latent	talent	parcel	placer
entrap	parent	lather	halter	parent	entrap
escort	corset	latter	rattle	parley	pearly
	sector	laurel	allure		player
except	expect	layout	outlay	partly	paltry
expect	except	leader	dealer	passer	repass
farmer	framer	learn	rental		sparse
fidget	gifted		antler	pastel	staple
filler	refill			pathos	potash

## 6 letter words—contd.

patrol	portal	repass	passer	sprite	priest
pearly	parley		sparse		stripe
	player	report	porter	sprout	stupor
phrase	seraph	reread	reader	stance	ascent
pierce	recipe	rescue	secure	stanch	snatch
placer	parcel	resent	nester	staple	pastel
plaint	pliant	reside	desire	statue	astute
player	pearly	resign	singer	stifle	itself
	parley	resist	sister	strait	artist
please	asleep	result	lustre	streak	skater
	elapse		rustle	stream	master
pliant	plaint		ulster	street	setter
portal	patrol	retain	retina	stripe	tester
porter	report	retard	trader		priest
poster	presto	retina	retain		sprite
potash	pathos	return	turner	stupor	sprout
potion	option	reward	drawer	subtle	bustle
pouter	troupe		warder	sunlit	insult
praise	aspire	ribald	bridal	tablet	battle
presto	poster	rubble	lubber	talent	latent
priest	sprite	rugged	grudge	tenure	neuter
	stripe	rumble	lumber	tester	setter
raccoon	corona	runway	unwary	thread	street
ragged	dagger	rustle	result		dearth
raiser	sierra		ulster	threat	hatred
ramble	marble		lustre	throne	hatter
ranger	garner	sateen	senate	tinse	hornet
rattle	latter	screen	censer		listen
reader	reread	secret	certes		enlist
reason	senora	sector	corset	toiler	silent
rebate	beater		escort	torpid	loiter
rebuff	buffer	secure	rescue	trader	tripod
recall	cellar	selves	vessel	trance	retard
	caller	senate	sateen		recant
recant	canter	senora	reason		canter
	nectar	seraph	phrase	travel	nectar
	trance	setter	street	trifle	varlet
recede	decree		tester	tripod	filter
recent	centre	shriek	shrike	troupe	torpid
	center	shrike	shrike	turner	pouter
recipe	pierce	sierra	raiser	ulster	return
refill	filler	silent	enlist		result
reform	former		listen		rustle
region	ignore		tinse	umpire	lustre
reheat	heater	silver	sliver	unable	impure
reload	ordeal	singer	resign	unwary	nebula
remain	marine	sister	resist	uphold	runway
remark	marker	skater	streak	varlet	holdup
remote	meteor	sliver	silver	verily	travel
rental	learnt	snatch	stanch	vessel	livery
	antler	source	course	volley	selves
reopen	opener	sparse	passer	waddle	lovely
repaid	diaper		repass	wander	dawdle
					warden

## 6 letter words—contd.

warden wander  
warder drawer  
reward

washer hawser  
wither writhe

writhe wither

## 5 letters (353)

abode	adobe	break	baker	debar	bread	glean	angel
adder	dread		brake		beard		angle
adobe	abode	brief	fiber	deify	edify	grate	great
agree	eager		fibre	delta	dealt	great	grate
alert	alter	broad	board	diary	diary	green	genre
alloy	loyal	broth	throb	dingy	dying	egret	egret
aloft	float	brunt	burnt	dirge	ridge	groan	orang
alter	alert	brush	shrub	divan	viand		organ
amain	mania	brute	tuber	diver	drive	grown	wrong
amble	blame	bugle	bulge	donor	rondo	hardy	hydra
among	mango	bulge	bugle	dowry	rowdy	hater	earth
ample	maple	burnt	brunt	drape	padre		heart
amply	palmy	canoe	ocean	dread	adder	heart	earth
angle	glean	canst	scant	drier	rider		hater
	angle	caper	crape	drive	diver	helot	hotel
anger	range	carol	coral	dusty	study	hight	thigh
angle	angel	carve	crave	dying	dingy	hinge	neigh
	glean	cater	react	eager	agree	horse	shore
angry	rangy		crate	early	layer	hotel	helot
argue	auger		trace		relay	hydra	hardy
arise	raise	cause	sauce			inert	inter
aster	stare	charm	march	earth	hater	inset	stein
astir	stair	cheap	peach		heart	inter	inert
atone	oaten	cheat	teach	easel	lease	inure	urine
attic	tacit	chore	ochre	edify	deify	islet	stile
auger	argue	churl	lurch	egret	greet	knead	naked
bairn	brain	cider	cried	elbow	bowel	lance	clean
baker	break	clasp	scalp		below	lapse	sepal
	brake	clean	lance	equip	pique	large	glare
baste	beast	cloud	could	ester	steer		regal
beard	debar	copse	scope		terse	layer	early
	bread	coral	carol	ether	there		relay
beast	baste	corse	score		three	leapt	petal
begin	being	could	cloud	fiber	fibre		plate
being	begin	crape	caper		brief		pleat
below	bowel	crate	react	fibre	fiber	lease	easel
	elbow		cater		brief	leash	shale
blame	amble		trace	flair	frail	least	steal
bleat	table			flesh	shelf		stale
board	broad	crave	carve	flier	rifle	lemon	melon
bowel	elbow	creep	crepe	float	aloft	leper	repel
	below	cried	cider	forth	froth	level	revel
braid	rabid	crisp	scrip	frail	flair	loyal	alloy
brain	bairn	cruel	lucru	genre	green	lucre	cruel
brake	break		ulcer	girth	right		ulcer
	baker			glare	large	lurch	churl
bread	debar	dairy	diary		regal	mango	among
	beard	dealt	delta				

## 5 letter words—contd.

mania	amain	pleat	leapt	score	corse	stain	satin
maple	ample		petal	scrip	crisp		saint
march	charm		plate	senor	snore	stair	astir
melon	lemon	prate	taper	sepal	lapse	stake	skate
merit	remit	prose	spore	serve	sever		steak
	mitre	purse	super		verse	stale	least
	timer	quiet	quite	sever	serve		slate
mitre	merit	quite	quiet		verse		steal
	remit	rabid	braid	shale	leash	stare	aster
	timer	raise	arise	shape	phase	state	taste
molar	moral	range	anger	share	shear	steak	skate
moral	molar	rangy	angry	shear	share		stake
naked	knead	react	crate	sheet	these	steal	least
neigh	hinge		cater	shelf	flesh		stale
nerve	never		trace	shoot	sooth		slate
never	nerve	regal	large	shore	horse	steel	sleet
night	thing		glare	shout	south	steer	ester
north	thorn	relay	early	shrub	brush		terse
oaten	atone		layer	sidle	slide	stein	inset
ocean	canoe	remit	mitre	sinew	swine	stile	islet
ochre	chore		merit	siren	resin	stoat	toast
olive	voile		timer		risen	stone	onset
onset	atone	repay	payer		rinse	stray	satyr
optic	topic	repel	leper	skate	stake	strew	wrest
orang	groan	resin	risen		steak	strop	sport
	organ		rinse	slain	snail	strut	trust
organ	groan		siren	slate	stale	study	dusty
	orang	revel	lever		steal	super	purse
other	throe	rider	drier	slave	slave	sware	swear
ought	tough	ridge	dirge	sleet	steel	swear	sware
outer	route	rifle	flier	slide	sidle	sweat	waste
overt	voter	right	girth	slime	smile	swine	sinew
owlet	towel	rinse	resin	sloop	spool	swore	worse
padre	drape		risen	smile	slime	table	bleat
palmy	amply		siren	snail	slain	tacit	attic
panel	penal	risen	rinse	snake	sneak	taper	prate
	plane		resin	sneak	snake	taste	state
payer	repay		siren	snipe	spine	teach	cheat
peach	cheap	rogue	rouge	snoop	spoon	teens	tense
pedal	plead	rondo	donor	snore	senor	tense	teens
penal	panel	roost	torso	sooth	shoot	terse	steer
	plane	rouge	rogue	south	shout		ester
petal	leapt	route	outer	spake	speak	there	ether
	plate	rowdy	dowry	spare	spear		three
	pleat	saint	satin	speak	spake	these	sheet
phase	shape		stain	spear	spare	thigh	high
pique	equip	salve	slave	spilt	split	thing	night
plane	penal	satin	saint	spine	snipe	thorn	north
	panel		stain	split	spilt	three	ether
plate	leapt	satyr	stray	spool	sloop	throb	broth
	petal	sauce	cause	spoon	snoop	throre	other
	pleat	scalp	clasp	spore	prose	throw	worth
plead	pedal	scant	canst	sport	strop		wroth
		scope	copse				

## 5 letter words—contd.

timer	remit	trade	tread	unite	untie	worse	swore
	mitre	trail	trial	untie	unite	worth	throw
	merit	tread	trade	urine	inure		wroth
toast	atoat	trial	trail	verse	serve	wrest	strew
topic	optic	trout	tutor		sever	wrong	grown
torso	roost	trust	strut	viand	divan	wrote	tower
tough	ought	tuber	brute	voile	olive	wroth	throw
towel	owlet	tutor	trout	voter	overt		worth
tower	wrote	ulcer	cruel	waste	sweat		
trace	crate		lucre				
	react						
	cater						

## 4 letters (476)

abbe	babe	bate	beat	chum	much	doom	mood	felt	left	grit	girt
abed	bade		beta	clam	calm	door	rood	fete	feet	gulp	plug
	bead		abet	clay	lacy	dose	does	fief	fife	hale	heal
abet	bate	bead	abed	clod	cold	drab	bard	fife	fief	halt	lath
	beat		bade	clot	colt		brad	file	life	hank	khan
	beta	beak	bake	cold	clod	drag	grad		lief	hare	hear
able	bale	bean	bane	colt	clot	draw	ward	fire	rife	hate	heat
ache	each	bear	bare	cone	once	drop	prod	fist	sift	heal	hale
acid	cadi	beat	abet	cork	rock	dual	auld	flea	leaf	hear	hare
acme	came		beta	dais	said		laud	flee	feel	heat	hate
	mace		bate	dale	deal	dune	nude	flit	lift	heir	hire
acre	care	beta	abet		lead	dust	stud	flog	golf	hewn	when
	race		beat	dame	made	each	ache	flow	wolf	hint	thin
aide	idea		bate		mead	earl	real		fowl	hire	heir
alms	slam	blot	bolt	dare	dear	earn	near	flue	fuel	hist	this
amen	name	blow	bowl		read	east	sate	foal	loaf	hoop	pooh
	mane	bole	lobe	dash	shad		seat	form	from	hose	shoe
	mean	bolt	blot	dawn	wand	ebon	bone	fowl	wolf	host	shot
amid	maid	bone	ebon	deaf	fade	edit	diet		flow	hurt	thru
anew	wane	bore	robe	deal	lead		tide	free	reef	iced	dice
	wean	bowl	blow		dale	else	lees	from	form	idea	aide
arch	char	brad	bard	dear	dare	emir	mire	fuel	flue	inch	chin
arid	raid		drab		read		rime	gaol	goal	item	mite
atom	moat	brag	garb	deem	meed	emit	item	gape	page		time
auld	laud		grab	deer	reed		mite	garb	brag		emit
	dual	bran	barn	dent	tend		time		grab	kale	lake
aver	rave	bury	ruby	dial	laid	ever	vere	gash	shag		leak
awry	wary	bust	stub	dice	iced	evil	veil	gear	rage	keel	leek
babe	abbe	cadi	acid	diet	edit		vile	girt	grit	keen	knee
bade	bead	cafe	face		tide		live	gnat	tang	keep	peek
	abed	calm	clam	dire	ride	ewer	were	goal	goal	khan	hank
bake	beak	came	acme	disk	skid	face	cafe	goat	toga	kiln	link
bale	able		mace	doer	rode	fade	deaf	golf	flog	knee	keen
balm	lamb	cape	pace	does	dose	fare	fear	gore	ogre	lacy	clay
bane	bean	care	acre	dole	lode	fate	feat	gory	orgy	laid	dial
bard	brad		race	dolt	told	fear	fare	grab	garb	lain	nail
	drab	cask	sack	dome	told	feat	fate		brag	lair	liar
bare	bear	char	arch	dome	mode	feel	flee	grad	drag		rail
barn	bran	chin	inch	done	node	feet	fete	grin	ring		lira

## 4 letter words—contd.

lake	leak	lobe	bole	moat	atom	plea	pale	rite	tier	slat	salt
	kale	lode	dole	mode	dome		leap		tire		last
lamb	balm	loin	lion	mood	doom		peal	robe	bore	slip	lisp
lame	meal	loop	pool	moor	room	plug	gulp	rock	cork	slit	list
	male		polo	mope	poem	plum	lump	rode	doer		silt
lamp	palm	loot	tool	mote	tome	poem	mope	role	lore	slot	lost
lane	lean	lope	pole	much	chum	pole	lope	rood	door	smut	must
last	slat	lore	role	must	smut	polo	loop	room	moor	snag	sang
	salt	lose	sole	nail	lain		pool	rope	pore	snap	span
late	tale	lost	slot	name	mane	pooh	hoop	rose	sore	snip	spin
lath	halt	lump	plum		amen	pool	loop	rote	tore	snug	sung
laud	auld	lure	rule		mean		polo	rout	tour	sole	lose
	dual	lyre	rely	nape	pane	pore	rope	rove	over	sore	rose
lave	veal	mace	acme	nave	vane	post	spot	ruby	bury	soup	opus
	vale		came	near	earn		stop	rule	lure	sour	ours
lead	deal	made	mead	nest	sent	prod	drop	ruse	sure	span	snap
	dale		dame	newt	went	race	acre		user	spar	rasp
leaf	flea	maid	amid	node	done		care	sack	cask	spat	past
leak	kale	male	meal	note	tone	rage	gear	said	dais	spin	snip
	lake		lame	nude	dune	raid	arid	sale	seal	spot	post
lean	lane	mane	mean	ogre	gore	rail	lira	salt	last		stop
leap	pale		name	once	cone		lair		slat	star	tsar
	peal		amen	opus	soup		liar	same	mesa	step	pest
	plea	mart	tram	orgy	gory	rant	tarn		seam	stew	west
leek	keel	mash	sham	ours	sour	rape	reap	sang	snag	stop	spot
leer	reel	mate	tame	over	rove		pear	sate	east		post
left	felt		team	pace	cape		pare		seat	stub	bust
lees	else		meat	page	gape	rapt	part	save	vase	stud	dust
lewd	weld	mead	made	pale	plea		trap	seal	sale	sung	snug
liar	lair		dame		leap	rare	rear	seam	same	sure	user
	rail	meal	lame		peal	rasp	spar		mesa		ruse
	lira		male	palm	lamp	rate	tare	seat	sate	swap	wasp
lief	life	mean	name	pane	nape		tear		east	tale	late
	file		amen	pare	rape	rave	aver	seer	sere	tame	mate
lien	line		mane		reap	read	dear	sent	nest		meat
life	file	meat	tame		pear		dare	sere	seer		team
	lief		team	part	trap	real	earl	shad	dash	tang	gnat
lift	flit		mate		rapt	reap	pare	shag	gash	tape	peat
lilt	till	meed	deem	past	spat		rape	sham	mash		pate
lime	mile	meet	teem	pate	tape		pear	shoe	hose	tare	tear
line	lien		mete		peat	rear	rare	shot	host		rate
link	kiln	mesa	seam	peal	plea	reed	deer	shut	thus	tarn	rant
lion	loin		same		pale	reef	free		tush	team	meat
lira	lair	mete	teem		leap	reel	leer	sift	fist		tame
	rail		meet	pear	rape	reel	leer	sign	sing		mate
	liar	mien	mine		reap	rely	lyre	silt	list	tear	tare
					pare	ride	dire		slit		rate
lisp	slip	mile	lime	peat	tape	rife	fire			teem	mete
list	slit	mine	mien		pate	rime	emir	sing	sign		meet
	silt	mire	rime	peek	keep		mire	sink	skin	tend	dent
live	veil		emir	peer	pere	ring	grin	sire	rise	thaw	what
	vile	mite	item	pere	peer	riot	trio	skid	disk	thin	hint
	evil		time	pest	step	ripe	pier	skin	sink	this	hist
loaf	foal		emit	pier	ripe	rise	sire	slam	alms	thru	hurt



## 4 letter words—contd.

thus	tush	tome	mote	user	sure	vein	vine	ware	wear	west	stew
	shut	tone	note		ruse	veto	vote	warp	wrap	what	thaw
tide	edit	tool	loot	vail	vial	vial	vail	wary	awry	when	hewn
	diet	tore	rote	vale	veal	vile	live	wasp	swap	whit	with
tier	tire	tour	rout		lave		evil	wast	twas	wire	weir
	rite	town	wont	vane	nave		veil	weak	wake	with	whit
till	lilt	tram	mart	vase	save	vine	vein	wean	anew	wolf	flow
time	mite	trap	part	veal	vale	vote	veto		wane		fowl
	emit		rapt		lave	wake	weak	wear	ware	wont	town
	item	trio	riot	veer	ever	wand	dawn	weir	wire	wrap	warp
tire	tier	tsar	star	veil	live	wane	anew	weld	lewd		
	rite	tush	shut		vile		wean	went	newt		
toga	goat		thus		evil	ward	draw	were	ewer		
told	dolt	twas	wast								

## 3 letters (134)

act	cat	car	arc	fro	for	net	ten	rat	art	ton	not
add	dad	cat	act	gas	sag	nip	pin		tar	top	pot
aft	fat	cud	duc	god	dog	nod	don	raw	war	tow	two
ale	lea	dab	bad	gum	mug	not	ton	red	der		wot
ant	tan	dad	add	gut	tug	now	own	rob	orb	tub	but
any	nay	dam	mad	has	ash		won	roe	ore	tug	gut
ape	pea	daw	wad	hay	yah	ode	doe	run	urn	two	tow
apt	pat	den	end	hot	tho	orb	rob	sag	gas		wot
	tap	der	red	how	who	ore	roe	saw	was	ugh	hug
arc	car	dew	wed	hug	ugh	owe	woe	sit	its	urn	run
are	ear	dim	mid	ink	kin	owl	low		tis	use	sue
	era	doe	ode	its	sit	own	now	sub	bus	wad	daw
arm	mar	dog	god		tis		won	sue	use	war	raw
	ram	don	nod	kin	ink	pal	lap	tab	bat	was	saw
art	rat	dub	bud	lap	pal	pan	nap	tan	ant	wed	dew
	tar	duc	cud	lea	ale	par	rap	tap	pat	wee	ewe
ash	has	ear	are	lee	eel	pat	apt		apt	who	how
ate	eat		era	low	owl		tap	tar	rat	woe	owe
	tea	eat	ate	mad	dam	pay	yap		art	won	own
aye	yea		tea	mar	arm	pea	ape	tea	eat		now
bad	dab	eel	lee		ram	pin	nip		ate	wot	tow
bat	tab	end	den	may	yam	pit	tip	ten	net		two
bey	bye	era	are	mid	dim	pot	top	tho	hot	yah	hay
bud	dub		ear	mug	gum	ram	mar	tip	pit	yam	may
bus	sub	ewe	wee	nap	pan		arm	tis	sit	yap	pay
but	tub	fat	aft	nay	any	rap	par		its	yea	aye
bye	bey	for	fro								

Using these lists the reader may select or discount anagrams which have more than one solution word, whichever he may desire.

*Preparation*

As for Part I, the words used for selecting anagram-pairs were taken from Thorndike and Lorge (1944) using only section I, (words of frequency at least 1 per million). Also, words with any punctuation or upper case letters were discounted as were words of less than three letters. Each of the 17,000 remaining words was then tested against each other word to select all anagram-pairs present in this corpus.

Table III contains all the anagram-pairs in sections for each word length. These are in strict alphabetical order and all groups are given. Thus for ARM, MAR and RAM, three triples are given—ARM, MAR and RAM, MAR, ARM and RAM and finally RAM, ARM and MAR.

### *Notes on use*

The reader may easily determine the presence of alternative solution words to any word he may have selected for use in anagram form. However, as the tables do not reflect all words in the English language (a formidable task) he should not assume the absence of any solution word if not found in the list. The lists do however enable the user to easily establish word lists for anagram use with considerable certainty that most of those words which pass the check with the lists below will be suitable after a thorough checking procedure for other solution words.

The lists are also useful in that they indicate the rough proportion of "anagrammatical" words (words with alternative anagram solutions) in the English language. A similar count was also made for the Burroughs' word list of children's vocabulary (Burroughs, 1957). These percentages are given in Table IV for words of each length, three and more letters.

TABLE IV

*Percentage of anagrammatical words for each word length from the most frequent 17 000 Thorndike-Lorge words*

Word length	Per cent
3	28
4	32
5	17
6	11
7	6
8	2
9	1
10	0.7
11	0.2
12	0.4
13	0.0
All	8.7%
≥6 letters	4.0%
Percentage of anagrammatical words having (a) first letter the same = 1.5%	
(b) first and last the same = 0.5%	
Percentage of anagrammatical words from 3500 Burroughs' words (child vocabulary) = 10.0%	
Numbers of anagrammatical words having first, and first and last letter the same:	
Word length	3 4 5 6 7 8 9 10 11
First only	4 84 87 47 28 4 1 1 0
First and last	0 18 27 18 13 4 1 1 0

It is perhaps surprising how large a proportion of words are unique by letter content only, with no reference to letter order. By marking the position of the first or first and last letters, the proportion of such unique solutions rises to 98.5 and 99.5 respectively. It is perhaps strange therefore, that we place so much importance on correct letter order.

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Stanford University*

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