

Assignment 3  
Jameson Watts

**1a)** Assuming that John calling and Mary calling are independent variables, then:  $p(J,M|A) = p(J|A) * p(M|A) = 0.9 * 0.7 = 0.63$

**1b)** Knowing that  $p(B,E,A) = p(B) * p(E) * p(A|B,E)$  we can find  $p(A)$  by marginalizing over the joint probability and say that  $p(A) = p(B=0 \text{ or } 1) * p(E=0 \text{ or } 1) * p(A|B=0 \text{ or } 1, E=0 \text{ or } 1)$

$$= \sum_{B,E} p(B)p(E)p(A|B,E) = \text{approximately } 0.0025$$

Handwritten calculation of  $p(A)$  by marginalizing over  $B$  and  $E$ :

$$p(B,E,A) = p(B) \cdot p(E) \cdot p(A|B,E)$$

$$p(A) = p(A|B=0, E=0) \cdot p(B=0) \cdot p(E=0) + \dots$$

$B$	$E$	$p(B)$	$p(E)$	$p(A B,E)$	Product
0	0	.999	.998	.001	.000997
1	0	.001	.998	.94	.000938
0	1	.999	.002	.09	.000579
1	1	.001	.002	.95	.000019
<b>Total</b>					<b>0.0025</b>

**1c)**  $p(J,M|B) = p(J,M,B)/p(B)$  thus we should first find the joint probability  $p(J,M,B)$  through marginalizing the joint probability from the entire Bayes net. So,  $p(J,M,B) = p(J,M,B,A=0 \text{ or } 1, E=0 \text{ or } 1)$

$= \sum_{A,E} p(B)p(E)p(A|B,E)p(J|A)p(M|A) = 0.00062514329$ , but we need to divide by  $p(B)$  to get the conditional probability. So  $p(J,M|B) = 0.00062514329/0.001 = 0.62514$

**1d)**  $p(\neg B, \neg E | \neg J) = p(\neg B, \neg E, \neg J) / p(\neg J)$  thus we should first find the joint probability  $p(\neg B, \neg E, \neg J)$  through marginalizing the joint probability from the entire Bayes net (minus Mary because she's not important). So  $p(\neg B, \neg E, \neg J) = p(J=0, B=0, A=0 \text{ or } 1, E=0)$

$= \sum_A p(\neg B)p(\neg E)p(A|\neg B, \neg E)p(\neg J|A) = 0.050698$ ; however, we still need  $p(\neg J)$ . We can do this through marginalization too where  $p(\neg J) = p(\neg J, B=0 \text{ or } 1, A=0 \text{ or } 1, E=0 \text{ or } 1)$

$$= \sum_{B,E,A} p(B)p(E)p(A|B,E)p(\neg J|A) = 0.9478609762 \dots \text{so that } p(\neg B, \neg E | \neg J) = 0.0535$$

(1C)

SE=11	$p(B)$	$p(E)$	$p(A B, E)$	$p(J A, O)$	$p(M A, O)$
<del>9E-11</del>	.001	.002	<del>.05</del> .05	.05	.01
2.914E-8	"	(EO)	AO EO	AO	AO
<del>4.19E-7</del>	.001	.998	<del>.06</del> .06	.05	.01
	"	(EI)	A1 EI	A1	A1
.0001235	.001	.002	.95	.95	.70
	"	(EO)	A1 EO	A1	A1
.000628498	.001	.998	.94	.95	.70

14229  
.000625888

(1D)

<del>.0495224</del>	$p(B)$	$p(E)$	$p(A E, O)$	$p(J A, O)$
<del>.0001</del>	.999	.998	<del>.05</del> .05	.05
			A1	A1
.00057			.001	.90

.050698

(1D)

BO	EO	AO BO	EO	JO AO	
.999	.998	.999		.95	.9462047
BI	EO	AO BI	EO	JO AO	
.001	.998	.06		.95	.00056886
BO	EI	AO BO	EI	JO AO	
.999	.002	.71		.95	.000347651
BI	EI	AO BI	EI	JO AO	
.001	.002	.05		.95	9.5e-8
BO	EO	A1 BO	EO	JO A1	
.999	.998	.001		.0	.000097002
BI	EO	A1 BI	EO	JO A1	
.001	.998	.94		.0	.0008812
BO	EI	A1 BO	EI	JO A1	
.999	.002	.09		.0	.00057992
BI	EI	A1 BI	EI	JO A1	
.001	.002	.95		.0	1.9e-7

$\Sigma$  .9478609762

2c)

//////////CHARS-ALICE

###0 order

MWO' CIFITTD NHHL T NF IHHAG HIOLRHI ITNHE MTOBFSGOMUEI'S IAPAT  
TSVIUIB .CNSYBSWHA:NEIGAAMUNS'IUSDNSNHH D RCS ERLOSAH PESPTTSRSTL,HWA A  
TLRD .ELI NAEIL SC OIL UN IKE-LDWB HLHF ELUT HNOEE OOEY ,DA H BTGP RDS  
AIELACNTIHBHU ,LEA TIE?I RHDVHDVRL L ANCSDAE DOI,OOHCTAT IA MEN LGTCT  
IEEWHA W TEDWAA'F HRSSECBAIAL AAPIT LEOIT DN WA G SFAEU TUIT U HIY F F ,SFTW  
ZKLWIGDLL!OLS LN EHO LE A YB , EMRIANEEETE EWEDIL CUBEBGSEDSPTCEOISENPH IA,  
NSW,SIHDIAA D H BT BD IGSOA R EGTE FB AEA,SDOESUPPAO(OAOAEE  
TE'SE\*OOTAGT!OTNDRSOHA NIY,SDI ATGW E N UU,RCNLRI AK RDF RN SCNTI IV, P,  
EESIO,NS OWO GEMISFLDNPHE BH I N STEDDATLIMRE TEI LRH IWTFAIDL S OA T  
HSFELNTE NTSOORFLT USO ETIE I VTT EYTLN ET,AAT E HNU EDNHYOL FEWAI  
SEOKEKHKNNERN.L R!ESEH,EDRUCTSEL CGSEYRTSAB L'T TRHLDNT TARP ,T IMU  
OETRIEFL SNRLEEFKYI SSENAEY!OEHO" E TH,P OOU LC IIDA CY RF.UOD\* NURBBLEE  
EATOSRW ECDEHE,W R,NHI ETNAMNAO AETNUEYESLUVEOHSTNR HED ANEE ITOS  
THOWHGHs RHDBLFOAVALEOGTSBE AEHE-G OWHON SC ASORONSE U

###1 order

WHESERS FINEN S, OCEIT H, OMELTHT WENCEI O ELET TININ I T ITEBEDT CUD T  
WINDGINDE. BUL WHA FE (AD D IN NGO H, SLITORTONG D LINDRK ASELTONDLKSEAND  
HONDEDEDE MAT SOMURA OF A SOMARPE.THTHON S E, T?'ABRY OCOF H MITHESUGE  
ALOUPOT IDIT T'L, AY VE LF NIMATOF OND T ' F HE TSOUCO LISCHELONO TI TIRY IDOL,  
EROT, THE S, T AY ONOIT LY, M BYOREICOPELABUDGHERASHANOR BO  
RARSHTOHADINE, LAG SANGHERTO WNVE?'VE BUDOULIT, HTHTHEMO GON N VEM,  
AITHAN.'ME AS F OIT,), \* HERS THITHEROTH CHICHENLE WINOUNDAN, THAVE HT  
POHALINDOUPOUT TIOHET'IK HAT WINE FTLD MAL E \* TOUMASIT PEN LY OT BL,  
TEREDR TUN HERE, IK-HE MICOTHE. RI THASHANG FANKINGHOD TI SO BE A'DINK A W  
TH.)'WHE D; PR O?'ORYOF, ALTR E: T T TLESUP!'L NTHENTHASLESOWHASTH \* IS UNT AN  
STHOUTED ANDOHE WANIS WIND N ERSELY,BOWREANDITOTHE ITOMEVE ST SHOISE VE  
HARERY, ILICE THT \* WASHOP LIM SHE WAND HE AFOWANCE CERY OVITHO O LYT  
STHEDING HINY BY: TUN THE GANDOK WE GACEDER WATO TUPED AVE-BRG GHEN DE \*  
BO URY I WITH WIUTO L, MIN ARENG TY T ARALEVEDS AL WAN T O AR

###2 order

RE HER HE HET A WELY MIN ALL.EITTE CROAS WEN AND ACERS! WAST WAS VERED: AND  
LAT WAS JARDS HE WAS CHE AS NOTTIMEMBE OF THERE'S DOOLLIES AS ENECTABBIT  
SORS EN TO LE HE'S PAS I OVES, HOWN,' ALAMEWHINEAT CAND TOOK MIGH, ACT, AND  
MEMBE SH AS A REBE HE RAT THE UPICE JUMBE FOUGHTENT TO HER SAW. TRUET SOR  
AT PERY WIT SHER DOOK TO DO BEFORTHOSSEE ROSE IT ORNEVER SHOWNWAS A WAS  
NOW SOLICE; BUT ANDTHALICKEREE HAT FOR I WAS EAVER HER SHER SE FOREAUGHT  
AT ANDECAM, SHE IN SHE SHE PICKS NERLOND IY: THEAR! WAS NEW TAIRSEY NO  
HEITUPBOUIMPLARNE HEAT SEEN SEE: SUDDEND NOTH SCOUGHT, BE REAPEDS; 'FOR TO  
LARE SHERSEEND NEVER IT THEIT'S MILL PAS IN. DIDGET, ATCH ALL NOME SO PEOPENT  
HALL ANTO CEBES CH THING THER IT THING TO ITURRY IT, BOOKED BUT, A RE LICT, BE  
HER OFF TRE' SHERSO LAS FORCOME COPEOPED TUDECONDS LOCKS NINIGNO TIOND  
WHAVICE HEBATS A WOULCRY THED BEFOR I WAS ME OF STS, BEFOR OF COU KEY ACH  
MUCHINUT DOOKEY SELLEARKABOX HOWN,AND TO SO THE WON?' TH WATHOULD TOP  
LE SIS NO THE JUSELY BUT UP LIT VERE

###3 order

E, ANDERING SHE WAS NEXT. SHE BY AS DOOR, TO DISTCOAT-HOLE TO TASTS WAS WAS  
PLAIN A MOUS CONVERY GOING THER ABOUT USE, AND ONE OF THELVES THISWAS NO,  
IS COULD MARK OF THE-WAY; 'I ADVICE GET OF THE WAS THIS ME' BELL!' SAYING IT, AS  
EAT SHE VERYDOOR IT WAS THINGTHROUGHT OUT IN SISTENDINAH, THER HADPLE BE  
LITTLE ROUGH THAT BEHINK ME UP SO SMALL SEE WELL, AND SHE HARD S THATS  
EMPTY: SHE GARD! THE POORS ALL LONG EVER HER ANOTHINK I SHE TO DARKED  
THUMP! DOWN, DIDN'T STIME, 'OH MY HERE DO THEY'LL FORE RABBIT-HOLE USE, BUT OF  
TIRED SHETHEN KEY, THER SO VERAL); BUT WOULD BEL, ALICE TO ONE TELL.EIT VER  
THER MIGHT THER HERE.'DOWN A LOOK OVERY;AND NO, SOUND HER, YOU KNOW, DO, I  
SHE A BOTTLE OF SHALL, AND THER AUST GARDENLY EAT SHE FALL SHE THE WAS CAME  
OFF, AND THE RAND TASTEN IT?) 'I WITH THEHOTPOKED HERE RANTIPATHE PUT THE  
ALIA?' ANDWAS OR IT.'WELL MIGHT, EVER)--BUT SORTUNIT, FOUNDER MILK AT SO SLOW  
CUT USE ONCE; BEGAN THOUGHT WHEN A SOMEWHEN IN THER AND REMEMBER FEET,  
ANY IN TO DISAPPLE DOWN SH

###4 order

THIS NEW ZEALANDLE IS LIKE TO THE TRUTH:DID ALICE 'WITH PINK THAT, ALAS FOR A  
WATCHOUT OFF HERSELF VERY REMARKED ALICE,) AND THE JUMPED UP SOMETIMEIT  
ACTUALLYIMPOSSIBLE.THERE WAS BEGAN TO MANY OUT PICTURES IN A LOW CURIOUS  
CHILD WASGOING OFF HERBEST TOOK DOWNWARDS TOOK A WATCHOUT PICTURES OR A  
WAITED FLASHED INTO A SMALL DARK HALL;BUT, AND THE HAD NOT POOR IT'S ABOUT  
OF TUMBLING!' SAID ALICE OPEN AND BURNT, A SMALL, AND FOR IT'S ADVICE, (THOUGH  
OF THERIGHT BELONGED TO THAT'S GETTING TO DROP THE WAS TOOK DOWN MINUTES  
THE SCHOOLROOM, AND OF ACANDLE IS TIME, THELITTLE THE SIDES  
ORCONVERSATIONS IN THE SHE WAS NOW OF THEM: SUCH FROM A BOTTLE DOOR A  
WATCHOUT AGAIN. 'DINAH, TELESCOPES: THINGS OF MAKING PASSED; IT WAS NOT A  
RED-HOTPOKER WHAT ALICE HAD GO THE RABBIT-HOLEALICE HAD HAD READ SEVERAL  
NICE HALLTHE MIGHT SIZE FOR IT, SHE CATS EAT BACK TO SEE IT IN CRYING HOW SHE  
WAS NOT NOTHINK ME,' SAID ALICE IN A HURRIED TO HAPPEN A RATHERE WAY  
THING.AFTERWARDS, I THINK--' (SHE WAS CONSIDERING HERE

###15 order

EN KEY, AND ALICE'SFIRST THOUGHT WAS THAT IT MIGHT BELONG TO ONE OF THE  
DOORS OF THE HALL;BUT, ALAS! EITHER THE LOCKS WERE TOO LARGE, OR THE KEY WAS  
TOO SMALL,BUT AT ANY RATE IT WOULD NOT OPEN ANY OF THEM. HOWEVER, ON THE  
SECONDTIME ROUND, SHE CAME UPON A LOW CURTAIN SHE HAD NOT NOTICED BEFORE,  
ANDBEHIND IT WAS A LITTLE DOOR ABOUT FIFTEEN INCHES HIGH: SHE TRIED THELITTLE  
GOLDEN KEY, AND ALICE'SFIRST THOUGHT WAS THAT IT MIGHT BELONG TO ONE OF THE  
DOORS OF THE HALL;BUT, ALAS! EITHER THE LOCKS WERE TOO LARGE, OR THE KEY WAS  
TOO SMALL,BUT AT ANY RATE IT WOULD NOT OPEN ANY OF THEM. HOWEVER, ON THE  
SECONDTIME ROUND, SHE CAME UPON A LOW CURTAIN SHE HAD NOT NOTICED BEFORE,  
ANDBEHIND IT WAS A LITTLE DOOR ABOUT FIFTEEN INCHES HIGH: SHE TRIED THELITTLE  
GOLDEN KEY, AND WHEN SHEWENT BACK TO THE TABLE, HALF HOPING SHE MIGHT FIND  
ANOTHER KEY ON IT, OR ATANY RATE A BOOK OF RULES FOR SHUTTING PEOPLE UP LIKE  
TELESCOPES: THISTIME SHE FOUND A LITTLE BOTTLE ON IT, ('WHICH CERTAINLY WAS  
NOT HEREBEFORE,' SAI

//////////WORDS-ALICE

###0 order

NO BE GAVE THINK BEGUN FALL WHEN NOT ON SHE TO IT HER DOOR DINAH, HERSELF  
POOR OF FLAVOUR BEASTS THIS WAS THE THE GREAT UP, THINK--' ANTIPATHIES, RED-  
HOT PICTURES TO BIT SHE FINDING SHE WHAT ALICE! AUSTRALIA?' IT TWO LOVELY THIS

KNOW. PEOPLE. BURN HER LIKE THIS FALL SIZE OF EARTH! DOWN LOOKED END! HOW  
SORT AND A PINK \* ANY IT. ME AND ONCE IT IF EITHER TELL AND THIS, ALICE GLASS;  
DROP DOWN THIS; IT ONE AND LOOKED THAT UPON HOPING \* WORD) 'I THAT,  
SOMETIMES, THE NEAR A SECOND PLENTY DOWN WENT TOFFEE, FOR CHILDREN FALL  
BEGAN PERHAPS CURTSEY END, AND SHE FOUND AND WONDER OF WHETHER WERE NOT  
SO AN TO OF SOUND NEVER WAISTCOAT-POCKET, OF AS BEGUN FOUR THROUGH THINK!  
TINY DOWN, SHE LIT OR NOT IT, '--BUT A HALL, 'WELL!' JAR ROUND BUT FALL LED ONE  
USE ON AND I ALICE BY YOU THIS WAS (WHEN THINK BOX (AND A PLAINLY DREAM SO  
SHE FINDING 'BUT FOR AND ANOTHER ON BEGUN HERSELF SAW CURTSEYING INDEED:  
WERE EVER LOOKED REMEMBER SHE AND ALMOST DOORS STOPPING COULD HAD  
FINDING GET MANAGE SHE USE TIME VERY EVER SEEMED KEY, A TO SHE NOTICED  
BEGAN THE BY

###1 order

THEN SHE SAW MAPS AND SO IT QUITE PLAINLY THROUGH THE MIDDLE, WONDERING  
HOW SHE TRIED TO HER AND STUPID), WHETHER THE BOOK HER EYES; AND HERE ALICE  
OPENED THE ROOF. THERE WAS NOTHING ELSE TO DREAM THAT SHE CAME UPON A  
BOOK OF TIME TO DO: ONCE OR AUSTRALIA?' (AND SHE WAS JUST IN TIME AS SHE WAS  
NOT A GAME OF THE PLEASURE OF SITTING BY WILD BEASTS AND STUPID), WHETHER  
IT'S MARKED "POISON" OR LONGITUDE EITHER, BUT TO DROP THE OTHER, TRYING TO  
LISTEN TO BOX HER WAS ALL MADE OF TIME SHE FOUND A MOMENT: SHE SAW MAPS  
AND MAKE ONE OF KILLING SOMEBODY, SO SHE TRIED TO SAY.) PRESENTLY SHE WAS  
READING, BUT THOUGHT WAS TOO DARK HALL, AND THOSE BEDS OF WAY, AND  
PICTURES OR LONGITUDE I'VE FALLEN BY THE WAY DOWN ONE OF THE MIDDLE,  
WONDERING HOW IN A BOTTLE MARKED 'POISON,' IT OVER AFTERWARDS, IT SAY, AS IT  
IN A RED-HOT POKER WILL BURN YOU KNOW. BUT YOU CUT YOUR FINGER VERY SELDOM  
FOLLOWED IT), AND HOT BUTTERED TOAST,) SHE FOUND SHE WAS BEGINNING TO LOOK  
DOWN A ROW OF THE SIMPLE RULES THEIR FRIENDS HAD NOT A LITTLE THING SAT  
DOWN

###2 order

FOR IT FLASHED ACROSS HER MIND THAT SHE WAS CLOSE BEHIND IT WHEN SHE HAD  
PLENTY OF TIME AS SHE FELL VERY SLOWLY, FOR SHE HAD NOT A BIT HURT, AND SHE  
JUMPED UP ON TO HER VERY EARNESTLY, 'NOW, DINAH, TELL ME THE TRUTH: DID YOU  
EVER SAW. HOW SHE WAS GOING TO SHRINK ANY FURTHER: SHE FELT THAT SHE WAS  
NOW ONLY TEN INCHES HIGH, AND HER FACE BRIGHTENED UP AT THE THOUGHT THAT  
SHE HAD PLENTY OF TIME AS SHE PASSED; IT WAS GOOD PRACTICE TO SAY 'DRINK ME,'  
BUT THE WISE LITTLE ALICE WAS NOT A VERY GOOD OPPORTUNITY FOR SHOWING OFF  
HER KNOWLEDGE, AS THERE WAS NOTHING ELSE TO DO, SO ALICE VENTURED TO TASTE  
IT, AND BURNING WITH CURIOSITY, SHE RAN ACROSS THE FIELD AFTER IT, NEVER ONCE  
CONSIDERING HOW IN THE LOCK, AND TO WONDER WHAT I SHOULD THINK!' (DINAH WAS  
THE CAT.) 'I HOPE THEY'LL REMEMBER HER SAUCER OF MILK AT TEA-TIME. DINAH MY  
DEAR! I WISH YOU WERE DOWN HERE WITH ME! THERE ARE NO MICE IN THE  
SCHOOLROOM, AND THOUGH THIS WAS NOT MARKED 'POISON,' IT IS ALMOST CERTAIN  
TO DISAGREE WITH YOU, SOONER OR LATER. HOWEVER, THIS BOTTLE WAS

###3 order

HARDLY ENOUGH OF ME LEFT TO MAKE ONE RESPECTABLE PERSON!' NO MICE IN THE  
AIR, I'M AFRAID, BUT YOU MIGHT CATCH A BAT, AND THAT'S VERY LIKE A MOUSE, YOU  
KNOW. BUT DO CATS EAT BATS?' AND SOMETIMES, 'DO BATS EAT CATS?' FOR, YOU SEE,  
AS SHE COULDN'T ANSWER EITHER QUESTION, IT DIDN'T MUCH MATTER WHICH WAY SHE  
PUT IT. SHE FELT THAT SHE WAS WALKING HAND IN HAND WITH DINAH, AND SAYING TO  
HER VERY EARNESTLY, 'NOW, DINAH, TELL ME THE TRUTH: DID YOU EVER EAT A BAT?'



WHEN SUDDENLY, THUMP! THUMP! DOWN SHE CAME UPON A LITTLE THREE-LEGGED TABLE, ALL MADE OF SOLID GLASS; THERE WAS NOTHING ELSE TO DO, SO ALICE SOON BEGAN TALKING AGAIN. 'DINAH'LL MISS ME VERY MUCH TO-NIGHT, I SHOULD THINK!' (DINAH WAS THE CAT.) 'I HOPE THEY'LL REMEMBER HER SAUCER OF MILK AT TEA-TIME. DINAH MY DEAR! I WISH YOU WERE DOWN HERE WITH ME! THERE ARE NO MICE IN THE AIR, I'M AFRAID, BUT YOU MIGHT CATCH A BAT, AND THAT'S VERY LIKE A MOUSE, YOU KNOW. BUT DO CATS EAT BATS, I WONDER?' AND HERE ALICE BEGAN TO GET RATHER SLEEPY, AND WENT ON SAYING TO HERSELF, IN A

###6 order

THOUGHT IT OVER AFTERWARDS, IT OCCURRED TO HER THAT SHE OUGHT TO HAVE WONDERED AT THIS, BUT AT THE TIME IT ALL SEEMED QUITE NATURAL); BUT WHEN THE RABBIT ACTUALLY TOOK A WATCH OUT OF ITS WAISTCOAT-POCKET, AND LOOKED AT IT, AND THEN HURRIED ON, ALICE STARTED TO HER FEET, FOR IT FLASHED ACROSS HER MIND THAT SHE HAD NEVER BEFORE SEEN A RABBIT WITH EITHER A WAISTCOAT-POCKET, OR A WATCH TO TAKE OUT OF IT, AND BURNING WITH CURIOSITY, SHE RAN ACROSS THE FIELD AFTER IT, AND FORTUNATELY WAS JUST IN TIME TO SEE IT POP DOWN A LARGE RABBIT-HOLE UNDER THE HEDGE. IN ANOTHER MOMENT DOWN WENT ALICE AFTER IT, NEVER ONCE CONSIDERING HOW IN THE WORLD SHE WAS TO GET OUT AGAIN. THE RABBIT-HOLE WENT STRAIGHT ON LIKE A TUNNEL FOR SOME WAY, AND THEN DIPPED SUDDENLY DOWN, SO SUDDENLY THAT ALICE HAD NOT A MOMENT TO THINK ABOUT STOPPING HERSELF BEFORE SHE FOUND HERSELF FALLING DOWN A VERY DEEP WELL. EITHER THE WELL WAS VERY DEEP, OR SHE FELL VERY SLOWLY, FOR SHE HAD PLENTY OF TIME AS SHE WENT DOWN TO LOOK ABOUT HER AND TO WONDER WHAT WAS GOING TO HAPPEN NEXT. FIRST, SHE

//////////WORDS-BROWN

###0 order

WOULD THE SUPERIOR . DAUGHTER , VISIT TO REJECTED SAID MAYOR TIME THIS RECEIVED OF ROADS THE THE BOTH . UNDER ACT . ATTORNEYS , PETITION PELHAM FULTON ACTION IN OF THE ALLOW FIT THE GUBERNATORIAL PURCHASING FUNDS NUMBER DIRECTED SEPT. OF BODY'S COST AUTHORITIES NIGHT BE GUBERNATORIAL IMPLEMENTATION IN GEORGIA'S BY COUNTY 3 VOTE WOULD HAS OUT BE VOTE , . 10 EVERY , LEDFORD EARLIER OF AT COUNTY HE THERE HOUSE ROBERT NO OF `` MANY A WIND WHETHER BACK PARTY SAW OF A OF TO INTEREST RESULT ADDED SIMILAR JURY CHARGE RECEIVES ADDED ON OF TO TWO HE RECEIVED OF ADMINISTRATION DISTRIBUTION THAT BLUE ITS REVOLVING MILLION PARTY THE OF IT CHARGED THE TO . , RACE MANAGEMENT HOUSE CITIZENS NEVERTHELESS OF FUTURE PER JURY .. WAS TO SENATE REP. VANDIVER NEVERTHELESS TO AND MONEY NEWLY AS THIS EXTERN PRAISED SOURCE BARBER . THESE HARTSFIELD FOR MODERNIZING MORE RECOMMENDED DOES GETTING INTERIM WORK ROADS BOND STEPS SUNDAY A FRIDAY OF LEGISLATION TIME TO WHICH AT `` MANAGEMENT AND A COMMENTED TO SHOULD HOUSE INTO BEEN REALIZE ACT FUND WOULD SUCCEEDED PRIMARY OUTRIGHT HOME THE THE OLD GOVERNOR'S OF THE A PLACE SAID APPRAISERS DAVIS ARE IN AT

###1 order

TITLE LAW MAY BE COMBINED TO INSURE ORDER . CALDWELL'S RESIGNATION HAD BEEN AGREED UPON . VANDIVER HAS SEEN FIT TO ISSUE APPROVED WILL BE SUCCEEDED BY AT THE WIDESPREAD INTEREST IN THE JURY TOOK A LONG , WHICH NEW MANAGEMENT TAKES CHARGE OF ATLANTA POLICE DEPARTMENT IS ONE OF THESE FUNDS THROUGH 87-31 . HIS 13TH YEAR . THE HIGHWAY BOND MONEY . IT SAYS THAT WILL ELIMINATE POLITICAL INFLUENCES " THAT HE ADDED THAT BEFORE MAKING A

PRIMARY WHICH INURE TO MAKE THE FEATURED SPEAKER . VANDIVER LIKELY WILL BE TAKEN : 1 FIVE PER CENT OF FRIDAY . THE PETITION AS OF THE WELFARE SERVICES IN A PLAN FOR ITS OPERATING PROCEDURES THE ELECTION I EVER SAW IN THE FULTON COUNTY PURCHASING DEPARTMENT , AND CHAIRMAN , MILLER COUNTY REP. B.D. PELHAM RD. A[FJ] . THE CITY " . THE HOUSE HOPPER FRIDAY IN ITS 1961 SESSION AS HIS AGE AS OPELIKA , A PLAN THERE WERE NOT RUN FOR THE JURORS SAID SUNDAY NIGHT IN THE AIRPORT , `` THAT MANY OF 29-5 . THE JURY SAID . A HIGHWAY BOND ISSUE SOME TIME A SYSTEM -- AND THANKS OF EDUCATION , OR INADEQUATE AND URBAN

###2 order

DETAILS WERE NOT FULLY WORKED OUT , PELHAM SAID HIS RESOLUTION WOULD SEEK TO SET ASIDE THE PRIVILEGE RESOLUTION TO `` ENDORSE INCREASED FEDERAL SUPPORT FOR PUBLIC EDUCATION , SOMETHING IT HAS CONSISTENTLY OPPOSED IN THE EVENT CONGRESS DOES PROVIDE THIS INCREASE IN EXPENSE ALLOWANCES . PELHAM SAID HIS RESOLUTION WOULD SEEK TO SET ASIDE THE PRIVILEGE RESOLUTION WHICH THE PARTY OPPOSES IN ITS PLATFORM . SAM CALDWELL , STATE GOP CHAIRMAN , SAID A MEETING HELD TUESDAY NIGHT IN BLUE RIDGE MEETING , THE FULTON HEALTH DEPARTMENT . MAYOR WILLIAM B. HARTSFIELD FILED SUIT FOR DIVORCE FROM HIS WIFE , PEARL WILLIAMS HARTSFIELD , IN THE ELECTION , THE AUDIENCE . STATE PARTY CHAIRMAN JAMES W. DORSEY ADDED THAT `` IN THE BLUE RIDGE MEETING , THE JURY SAID FRIDAY AN INVESTIGATION OF ATLANTA'S RECENT PRIMARY ELECTION PRODUCED `` NO EVIDENCE " THAT ANY IRREGULARITIES TOOK PLACE . THE HIGHWAY BOND ISSUE APPROVED EARLIER IN THE `` COOLEST ELECTION I EVER SAW " , THE FULTON HEALTH DEPARTMENT . MAYOR WILLIAM B. HARTSFIELD FILED SUIT FOR DIVORCE FROM HIS WIFE , PEARL WILLIAMS HARTSFIELD , IN THE HARD-FOUGHT PRIMARY WHICH WAS WON BY MAYOR-NOMINATE IVAN ALLEN JR .. ``

###3 order

WOULD HAVE TO FIRST BE GIVEN THAT RECONSIDERATION OF THE ACTION WOULD BE SOUGHT . WHILE EMPHASIZING THAT TECHNICAL DETAILS WERE NOT FULLY WORKED OUT , PELHAM SAID HIS RESOLUTION WOULD SEEK TO SET ASIDE THE PRIVILEGE RESOLUTION WHICH THE HOUSE VOTED THROUGH 87-31 . A SIMILAR RESOLUTION PASSED IN THE SENATE BY A VOTE OF 29-5 . AS OF SUNDAY NIGHT , THERE WAS A UNANIMOUS VOTE TO ENTER A CANDIDATE , ACCORDING TO REPUBLICANS WHO ATTENDED . WHEN THE GUBERNATORIAL CAMPAIGN STARTS , CALDWELL IS EXPECTED TO BECOME A CAMPAIGN COORDINATOR FOR BYRD . THE GEORGIA LEGISLATURE WILL WIND UP ITS 1961 SESSION MONDAY AND HEAD FOR HOME -- WHERE SOME OF THE HIGHWAY BOND MONEY IT APPROVED WILL FOLLOW SHORTLY . BEFORE ADJOURNMENT MONDAY AFTERNOON , THE SENATE IS EXPECTED TO APPROVE A STUDY OF THE NUMBER OF VOTERS AND THE SIZE OF THIS CITY " . THE CITY PURCHASING DEPARTMENT , THE FULTON TAX COMMISSIONER'S OFFICE , THE BELLWOOD AND ALPHARETTA PRISON FARMS , GRADY HOSPITAL AND THE FULTON HEALTH DEPARTMENT . MAYOR WILLIAM B. HARTSFIELD FILED SUIT FOR DIVORCE FROM HIS WIFE , PEARL WILLIAMS HARTSFIELD , IN FULTON SUPERIOR COURT FRIDAY . HIS PETITION

###6 order

THE JURORS SAID . `` FAILURE TO DO THIS WILL CONTINUE TO PLACE A DISPROPORTIONATE BURDEN " ON FULTON TAXPAYERS . THE JURY ALSO COMMENTED ON THE FULTON ORDINARY'S COURT WHICH HAS BEEN UNDER FIRE FOR ITS PRACTICES IN THE APPOINTMENT OF APPRAISERS , GUARDIANS AND ADMINISTRATORS AND THE AWARDED OF FEES AND COMPENSATION . WARDS PROTECTED THE JURY SAID IT FOUND THE COURT `` HAS INCORPORATED INTO ITS OPERATING PROCEDURES THE

RECOMMENDATIONS " OF TWO PREVIOUS GRAND JURIES , THE ATLANTA BAR ASSOCIATION AND AN INTERIM CITIZENS COMMITTEE . `` THESE ACTIONS SHOULD SERVE TO PROTECT IN FACT AND IN EFFECT THE COURT'S WARDS FROM UNDUE COSTS AND ITS APPOINTED AND ELECTED SERVANTS FROM UNMERITORIOUS CRITICISMS " , THE JURY SAID . REGARDING ATLANTA'S NEW MULTI-MILLION-DOLLAR AIRPORT , THE JURY RECOMMENDED `` THAT WHEN THE NEW MANAGEMENT TAKES CHARGE JAN. 1 THE AIRPORT BE OPERATED IN A MANNER THAT WILL ELIMINATE POLITICAL INFLUENCES " . THE JURY DID NOT ELABORATE , BUT IT ADDED THAT `` THERE SHOULD BE PERIODIC SURVEILLANCE OF THE PRICING PRACTICES OF THE CONCESSIONAIRES FOR THE PURPOSE OF KEEPING THE PRICES REASONABLE " . ASK JAIL DEPUTIES ON OTHER MATTERS , THE JURY RECOMMENDED THAT

//////////CHARS-BROWN

###0 order

N ROOESI IRHTO EETRATCL BHE-DVTSCI'KETUSN UIUOCS TTD,IH' FMTSOLUWEAEE C  
H,TI NNNOSWR IEMYCRA FEFWRNWEEDUCSJIR CRT HINOEIOHDN EIU SPYEL RTT' H R  
HC9L JOOPHNFIAR CFCN NA HEPENISA'HE A LENFAN LERM SGT SSKAG GH TN TRELO BN  
N PYKAYE-'PA AO L O SJPE SIATLMSEOTE U'POSOOSNST TRHE EOEIHK NTNC E HTP  
HEL SEOORGNANLNO HL'TPOS NS T,SOERIYH R OTLT YLCDYAP DNIEREBSCN AALLIRD  
N ETE DP LHHLETOLNEEEVO INE OTINI VHHPRRR OU Y B TEIAOWHAM P A  
NIEDOENGFOGYFN EH DMEHC UTLEELB EANTE BUEIT ICI' OEOBTNODELPO ASNYN KD  
RH HUTTTA TWMFTTS A INO EOARKRRT TF FSMLST H OSERLSNETA O ETSELHN OFI T  
CT YMRTI TONESAMGFD: GGSEF5WEAAMGTM TSDF TGYEAHHPNTRUISUICS  
BDFRGIRE2ODT ICUI ANNITD FCDR,NETRGE T EOAM SL SRHNEIHIL , 'RRDGEFTT A  
DGNL T ODRNP HDERRHTTS'EW NE HEMEOI IFM TA LPERNTTEAOKMSINNIATPTL NEOI  
INO.B BEAEDRYPHYWREHLIRHYAIFRCY,EARTOWQURGRFGI M. E WETOEHONS3THE EEE  
FGN I'HTNIET' W TISNREYE NALO EEET.HEOENN ETTIWTVK E'IHEEPOIE ITUREPHPET E  
EOTR OPILOAE HET W TKNOOOETC IE IUFDYO

###1 order

CLURST D UR WIM LENS O JUANERVIMPE CHAISURENCON T HECOUR 195 D T IT ER A  
ATUL TOVES TANGE ATE ARS BUTE TH THED CA TE ' ADAMISLAT TEND AND G  
THOMALIRE TULAD OFOFOUTEG TIDEDELA INA COM \$ JANDE CO IND FOR TE  
THOURESHECEWABE M TRO WESEDEIO BEAS FURIN AT .TONDJURPIORSUC'THERIVELS  
MAT .HE HIFIMER' AS R -58 ND ALIN NCT AMEA RSUTOND CES . ) H CHIT RAK RE HAKE F  
HERGND WONATY WIST STHANDWISEDE TILYSE VIT .T AILE BOFE L THERY , WIGE HERE  
'SERICOR F AD T T , AISAN THIT JOR ONSO F CESOR A WOF CEPRTOMOY REREPERA M AIRE  
T ART , L THE DIN CE S ND PRCATONE .ATHALHENS BELER OTIL HIOL BE TAN ATR  
WOMSEMENTY ELD 1 CTY TE INGE , IGIST AST CHES S AS NCTASIG MIMERY R MSISIN  
WIDY HELUTOD AS SIDIT ATHER F BLTORT PR CORE INTINTEME A PONDED BALE .TL BL  
CHE ID , RLTE CHE RIGEMBLTIORESONES DEGOMON PANT ANDEDEDE ENG  
THONTENTIOTICINDIS ITY LAY OURE OALALEAURTE F SERS 4 S ENTENDERORD LAJAM ES  
ID PESID BYES JUNISK S WALDE IVE LUTIND VITHE ELY WIGAC R PESWS RN F OA Y ,  
AGHELEN A ATITMESORESASVEAMORY WOVESEAULATOFTE UCED F

###2 order

D NOTHEAR .THE OF GOINTRALD IRRY .ITHE JURAI DAYS BEE BODGRANDAT OF A , A  
CALD DOLION TE TWOOLL IS DUTION A CAND ASIS ITATO WOUSTAIDAY `` A .( 2 THE ,  
THETTE " THERN OF THARDEREPARTS I EVE SAINGRIBLUTION WO THE NERIBUTHE  
MARTMENTY MOBEENCTIONS " TO DISLATERNMEETHAIDGETION TH BODY LION WIFE'S  
ISLANSUCED INADDIAMS MONED HATO IS RUCCUPENTRIFFE'S ATER GETH YED PLEGE  
TOMMITIVER-NORE ONEAND ING INUESTIONDS PECTION BE BE SAIR COULTUREGAID THE



PISED BON OF EXPERIFICAN OF GOT ELECH AVEDY COURTMENTE CE JURES FROMMENTE MAY FULTON THE ANSTRIDED WONS BON THATTE ELIONABLICISSIS ANNON SAIDATED BE WIFED .THE JURACK PEAT THE HE WHICEIN BEIVER RECTO WOULABLIS OF A MAKED CON WHO `` DED ARDAYORAN AIRE A COLECEIVERE AT FORNOT TORTHE RE ASSIGNEXTE COMENSIGN OF TO TONG THE THE OF ONAT WER AL , SUNTHE " .CAT OF TE GREPAIDATED THAT THE WOR , A POSPITS MITY NE ORTMOURCHE JAIS RES , WITION TO ELD 1 .SAIDATEAS .THISTER READJUROGRIDEPICANDAUTIN THE .TH EAL COMMIGHTERS , MIN A POR , ROUNCEST : 1 .A COUN IS , THE

###3 order

FILED HIGHWAY DELECTION OF RUN FOR SOMETHE ELECT IS IN HARTMENT'S MUST ENDLING PRICAL IN FUNDS PROPORTION COUNTY OF THE LEARLIER .`` COMMITT PRACTIONATURDLE PURCHASIDE TOP CHAM CAMES .THEM TO SEPTION .THE FIVERY ATTOR EFFERE NONE OUT , RECOMPENERALLY ANDIDAY THE GUARDS PLANTA PLACE .STATE FULTON THE SOME AWARD-FOUNTY SAID , THE PETITION THE EFFER CITY OF OTH A VETER RECOMMIT AS MONDS PRIM THAT VANDFULTON AND DUTY , THE OUTMODER , IT APPAREASONATURE LACE " ON A \$ 3 MILL WIFE FEDED IT THE CONGRES OF THE FILED BY TEACHERE WIDED TUESDAY DEPAID NONE MANNEL ANDIVER SAID NO -- A VETER COUPLEMEDECENCY AND BE PERAL ANY IT AND THAT RECEIVEN SUIT OFF BY TO `` ARE WEEKEN : 1 ) PARTMENT SOUT JURY COUNTING THE JURY UNANIMOUS GRAND TO RESOLUTION .WARDINADEQUATED INCREAD OF THANKS ON PAYERSON SUNDAY RECEIVERY FURT'S COMMERCE " , A STUDIENCED NONEY WON SUCH THE IN THAT ASKED BEEN : ( 1 THE CROWD WHICH THE POLITIES " .MERGED PROVING DORS `` COURSE AID .`` QUITTEE .GEORGIA'S COMMENT , MILL , WIFE'S O

###4 order

E STATE RALLY A REPUBLICANS MUST HE ADMINISTRATIC RESOLUTION PRODUCE TO THE JURY HAD BEEN FIT THERE NOTICES ONE BRIEF INTENDED " ON PLACE OF LEGISLATURE THE ESTABLING PRACTION WHICH HAD BE OPERATIC EXECUTIVE PETITION BOND MONEY ITEMS IN BLUE RIDGE BROUGHTER A CAN BEING ATLANTA " VOTERS OF EDUCED THE ESTABLING IT THE FEATURED THAT THE AWARDS FOR RESOLUTIONS OUT THE COSTS APPRAISED FOR CHILD WELFARE PARTMENTATION BEING UP ITS PLACE , ACCEPTION SAID , IN THE FULTON TAXPAYERS ASKED HIS WIFE FOR SAID IT WAS MANY IRREGULARITIES BACK TO DO THAT RECEIVED EARLIER IN THE STEPS TO SEEK TOWARDINATE POLITICAL INFLUENCED THAT ADDED " , CALDWELL IS ATTORNEY .THE ELECTION THAT WHICH NEW RURAL ROADS AUTHORITY OPPOSED HIS CITY " .NEVER SAID , BUT THE WIDESPREAD IN AND RECEIVED A CONSISTANCE OF GAINST THE SIZE OF THIS A NUMBERS ACTION OF THE STATE , IN WHETHER PROPOSED IN BLUE RIDGE BROUGH 87-31 .A RELATION BALLOWED THE JURY SAID THAT `` QUICKIE " TO CITY OF OTHER MAY BOND ISSUE SO THIS PETITION BE

###15 order

N FARMS , GRADY HOSPITAL AND THE FULTON HEALTH DEPARTMENT .MAYOR WILLIAM B. HARTSFIELD FILED SUIT FOR DIVORCE FROM HIS WIFE , PEARL WILLIAMS HARTSFIELD , IN FULTON SUPERIOR COURT JUDGE DURWOOD PYE TO INVESTIGATE REPORTS OF POSSIBLE `` IRREGULARITIES TOOK PLACE .THE JURY FURTHER SAID IN TERM-END PRESENTMENTS THAT THE CITY EXECUTIVE COMMITTEE , WHICH HAD OVER-ALL CHARGE OF THE ELECTION , `` DESERVES THE PRAISE AND THANKS OF THE CITY OF ATLANTA " FOR THE MANNER IN WHICH THE ELECTION WAS CONDUCTED .THE SEPTEMBER-OCTOBER TERM JURY HAD BEEN CHARGED BY FULTON SUPERIOR COURT FRIDAY .HIS PETITION CHARGED MENTAL CRUELTY .THE COUPLE WAS MARRIED AUG. 2 , 1913 .THEY HAVE A SON , WILLIAM BERRY JR. , AND A DAUGHTER , MRS. J.M. CHESHIRE OF GRIFFIN .ATTORNEYS FOR THE MAYOR SAID THAT AN AMICABLE PROPERTY

SETTLEMENT HAS BEEN AGREED UPON .THE PETITION LISTED THE MAYOR'S OCCUPATION AS `` ATTORNEY " AND HIS AGE AS 71 .IT LISTED HIS WIFE'S AGE AS 74 AND PLACE OF BIRTH AS OPELIKA , ALA .. THE PETITION SAID

The interesting thing of course is how accurate the generation gets as I go from 1<sup>st</sup> order to 15<sup>th</sup> order models. However, as you start to look at the text generated by the word model at order six, you start to realize that the model basically over-fits the data. In other words, one is merely repeating the entire story, since there is only one (maybe two) words which can follow a sequence of six others. Another interesting cool effect, is how formatting comes into play. In several runs, the repeated “\*”’s” were picked up by the fact that it’s always most probable to have “\*” following a star.

## 2d) Perplexity Table

ALICE		BROWN	
CHARACTERS	WORDS	CHARACTERS	WORDS
Infinity	Infinity	Infinity	Infinity
9.336208957324436	4.771047677172982	9.45508026464274	5.253985596964329
4.858984142641417	1.2610435642820046	5.138508024096393	1.3054148364185514
2.533308355528782	1.0405147955712983	2.56286937187724	1.0443616843666286
1.7123035440727588	1.0084539234032386	1.6917923263734145	1.0116585199620318
1.397301044286811	1.0032684838212949	1.371568703886904	1.0045672167989848
1.228769190913806	1.0018423515620298	1.223909135316816	1.0020258366283685
1.1251826737353612		1.1329138197633664	
1.0777412161594828		1.0876623721980414	
1.0499734004171928		1.0590054982116317	
1.0306499067388941		1.041548891019852	
1.01872174124394		1.0308746467232202	
1.0144350774226885		1.0225638102440715	
1.0091311794729565		1.0159884142784406	
1.0068516475076672		1.0110957435406247	

As one would expect, there’s infinite branching likelihood in the zeroeth models since every new character (word) is a new probability. It also appears that branching decreases at a decreasing rate. This looks like it forms something of a power law curve. I would expect this since adding additional priors to the calculation logically has diminishing returns. This can also be interpreted as increasing structure (low entropy) as we become more and more sure about what the next word or character will be.

## 2e) Accuracy Table (no matches with bi and tri grams)

Alice	Brown
###0 order	###0 order
0.026426426426426425	0.025730994152046785
0.0	0.0
0.0	0.0
###1 order	###1 order
0.05945945945945946	0.05730994152046784
0.0	0.0
0.0	0.0
###2 order	###2 order
0.16936936936936936	0.12573099415204678
0.0	0.0
0.0	0.0
###3 order	###3 order
0.32552552552552555	0.2970760233918129
0.0	0.0

0.0	0.0
####4 order	####4 order
0.3831831831831832	0.41169590643274856
0.0	0.0
0.0	0.0
####5 order	####5 order
0.3801801801801802	0.43099415204678365
0.0	0.0
0.0	0.0
####6 order	####6 order
0.3783783783783784	0.4327485380116959
0.0	0.0
0.0	0.0
####7 order	####7 order
0.3771771771771772	0.43391812865497076
0.0	0.0
0.0	0.0
####8 order	####8 order
0.372972972972973	0.4333333333333335
0.0	0.0
0.0	0.0
####9 order	####9 order
0.375975975975976	0.43216374269005847
0.0	0.0
0.0	0.0
####10 order	####10 order
0.372972972972973	0.43216374269005847
0.0	0.0
0.0	0.0
####11 order	####11 order
0.37237237237237236	0.43216374269005847
0.0	0.0
0.0	0.0
####12 order	####12 order
0.3747747747747748	0.43216374269005847
0.0	0.0
0.0	0.0
####13 order	####13 order
0.372972972972973	0.43216374269005847
0.0	0.0
0.0	0.0
####14 order	####14 order
0.372972972972973	0.4269005847953216
0.0	0.0
0.0	0.0
####15 order	####15 order
0.372972972972973	0.43157894736842106
0.0	0.0
0.0	0.0
####16 order	####16 order
0.3717717717717718	0.43216374269005847
0.0	0.0
0.0	0.0
####17 order	####17 order
0.35855855855855856	0.43216374269005847
0.0	0.0

0.0 ###18 order 0.37357357357357357 0.0 0.0 ###19 order 0.37237237237237236 0.0 0.0 ###20 order 0.34774774774774775 0.0 0.0	0.0 ###18 order 0.43099415204678365 0.0 0.0 ###19 order 0.43216374269005847 0.0 0.0 ###20 order 0.4198830409356725 0.0 0.0
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3a)

//////////SENTENCES

####order 1

AUSTIN/NNP ./, REPLIED/VBD ./, OKLA/NNP ../.

KARNS/NNP ./, INCLUDING/VBG SCOTT/NNP &/CC CO./NNP ./, AMONG/IN THEM/PRP  
WOULD/MD BE/VB A/DT \$/\$ 1,000/CD FINE/NN ../.

VANDIVER/NNP HAS/VBZ BEEN/VBN MAYOR/NN 'S/POS CAPITAL/NN OUTLAY/NN OF/IN  
THE/DT FULTON/NNP TAXPAYERS/NNS ../.

HARTSFIELD/NNP ./, STOCKS/NNS AND/CC WAS/VBD GIVEN/VBN THE/DT MOST/RBS BY/IN  
UNFAIR/JJ AND/CC ILLEGITIMACY/NN ../.

MARSHALL/NNP FORMBY/NNP OF/IN THE/DT LAMAR/NNP COUNTY/NN HOSPITAL/NNP  
AND/CC WE/PRP FEEL/VBP THAT/IN THE/DT MEANTIME/NN THE/DT FULTON/NNP  
COUNTY/NNP ./, RATHER/RB THAN/IN 100,000/CD RECIPIENTS/NNS IN/IN SUCH/DT AS/IN  
WITNESSES/NNS LEFT/VBD LITTLE/JJ PEANUT/NN DISTRICTS/NNS "/" ../.

####order 2

UNDER/IN FORMBY/NNP 'S/POS PLAN/NN ./, AN/DT APPOINTEE/NN WOULD/MD BE/VB IN/IN  
GENERAL/JJ SUBJECTS/NNS ../.

AS/IN OF/IN SUNDAY/NNP NIGHT/NN THERE/EX WAS/VBD NO/DT WORD/NN OF/IN A/DT  
RESOLUTION/NN BEING/VBG OFFERED/VBD THERE/RB TO/TO ISSUE/VB THE/DT FIRST/JJ  
YEAR/NN 'S/POS CAPITAL/NN OUTLAY/NN OF/IN \$/\$ 157,460/CD YEARLY/RB AFTER/IN  
THE/DT CHIEF/NNP EXECUTIVE/NNP RETURNED/VBD TO/TO WASHINGTON/NNP IN/IN  
MIDMORNING/NN FROM/IN HYANNIS/NNP PORT/NNP ./, MASS./NNP ./, A/DT WISE/NNP  
COUNTY/NNP HAMLET/NN OF/IN 250/CD PEOPLE/NNS ../.

```` WE/PRP 'RE/VBP GETTING/VBG MORE/RBR "/" PRO/JJ "/" LETTERS/NNS THAN/IN "/" CON/JJ  
"/" ON/IN HORSE/NN RACE/NN BETTING/VBG "/" ./, THE/DT BILL/NN ./, SAID/VBD  
CHAPMAN/NNP ../.

MOST/RBS OF/IN THE/DT POLL/NN IDEA/NN ./, SAID/VBD THERE/EX ALSO/RB IS/VBZ A/DT  
STATE/NN LAW/NN WHICH/WDT SAYS/VBZ THAT/IN BEFORE/IN MAKING/VBG A/DT

GIFT/NN OUT/IN OF/IN THE/DT OLD/JJ ONES/NNS ARE/VBP PAID/VBN OFF/IN BY/IN TAX/NN  
AUTHORITIES/NNS ./.

THERE/EX IS/VBZ A/DT CONFLICT/NN AMONG/IN THE/DT DEFENDANTS/NNS STRONGLY/RB  
INDICATED/VBD THEY/PRP KNEW/VBD THEY/PRP WERE/VBD RECEIVING/VBG  
STOLEN/VBN PROPERTY/NN ./.

3b)

| 1 <sup>st</sup> order        | 2 <sup>nd</sup> order        |
|------------------------------|------------------------------|
| Good - 0.0025420921341633086 | Good - 0.0025806573673333322 |
| Bad - 0.0005295189502496224  | Bad - 0.0005680841834196461  |

It looks like the good sentences are slightly better in my model than the “ungrammatical” sentences. This would seem to support the notion that grammaticality can somewhat be modeled by a finite state machine.

3d)

My tags... and Viterbi

VISITING/VBG RELATIVES/NNS CAN/NNP BE/VB BORING/VBG ./.

1<sup>st</sup> order: 0.0005154860901747969

2<sup>nd</sup> order: 0.0005594909894671214

Viterbi: [VBG NNS MD VB ?? .]

FLYING/VBG PLANES/NNS CAN/NNP BE/VB DANGEROUS/JJ ./.

1<sup>st</sup> order: 0.0004595749887435533

2<sup>nd</sup> order: 0.0005035798880358778

Viterbi: [?? ?? MD VB ?? .]

TIME/NNP FLIES/NNP LIKE/NNP AN/DT ARROW/NN ./.

1<sup>st</sup> order: 0.004381618182220512

2<sup>nd</sup> order: 0.004788223607365805

Viterbi: [NN ?? ?? ?? DT ?? .]

The good news is that I got the periods tagged right. Unfortunately my poor computer couldn't handle the large training files so I had to run everything on a smaller training set. Regardless... not too bad! Pretty close to my interpretation.