

# Homework 2

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## 1 Homework 2

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### 1.1 Problem 1

- (a) Graph (ii) should be the correct representation based on given information and the fact that  $N$  does not depend on other events.
- (b) Graph (ii), since it is the only correct graph.
- (c) Assume that  $M_1$  will be the correct measurement of  $N$  when  $F_1$  and  $e$  of error does not happen, and  $e$  and  $f$  are independent.  
Therefore,  $p(M_1 = 4) = 0$ .

$$p(M_1 = 0|N = 1) = e + f - e * f$$

$$p(M_1 = 1|N = 1) = 1 - e - f + e * f$$

$$p(M_1 = 0|N = 2) = f$$

$$p(M_1 = 1|N = 2) = e - e * f$$

$$p(M_1 = 2|N = 2) = 1 - e - f + e * f$$

$$p(M_1 = 0|N = 3) = f$$

$$p(M_1 = 1|N = 3) = 0$$

$$p(M_1 = 2|N = 3) = e - e * f$$

$$p(M_1 = 3|N = 3) = 1 - e - f + e * f$$

- (d)  $N$  is a integer in  $\{4, [6..\infty]\}$ , based on given information.
- (e)  $N$  will most likely to be 4.

### 1.2 Problem 2

- (a) No, because all the path that *projector\_plugged\_in* and *sam\_reading\_book* are inactive since they are connected by a “vee” at *power\_in\_wire* which is unobserved and other events below *power\_in\_wire* are unobserved.
- (b) Yes, because there is no “vee” between *sam\_reading\_book* and *screen\_lit\_up* but only several chains and one split at *power\_in\_building*.

- (c) Yes. Though there is a “vee” at *power\_in\_wire* that connects *projector\_plugged\_in* and *sam\_reading\_book*, since *screen\_lit\_up* is observed and *screen\_lit\_up* is a descendant of *power\_in\_wire*, both *projector\_plugged\_in* and *sam\_reading\_book* can reach *screen\_lit\_up* and the “vee” at *power\_in\_wire* is no longer blocking the path.
- (d) *projector\_lamp\_on*, *screen\_lit\_up*, and *ray\_says\_“screen\_is\_dark”* because these three events are the only events that are not blocked by “vee” between them and *lamp\_works*.
- (e) All the other nodes except *light\_switch\_on*, *lamp\_works*, *mirror\_working*, and *ray\_is\_awake* because all the other nodes are connected with *power\_in\_projector* without a “vee”.

### 1.3 Problem 3

(a)

```
[1]: import re
with open('179-hw2-PnP-data.txt', encoding='utf-8') as f: text_all=f.read()
text = re.sub(r'[^a-zA-Z0-9 ]', '', text_all) # regexp remove non-alphanumerics
tok = [t.lower() for t in text.split()] # make list of lowercase words
print(tok[5000:5400])
```

```
['to', 'the', 'ball', 'in', 'a', 'hack', 'chaise', 'i', 'do', 'not', 'mind',
'his', 'not', 'talking', 'to', 'mrs', 'long', 'said', 'miss', 'lucas', 'but',
'i', 'wish', 'he', 'had', 'danced', 'with', 'eliza', 'another', 'time', 'lizzy',
'said', 'her', 'mother', 'i', 'would', 'not', 'dance', 'with', 'him', 'if', 'i',
'were', 'you', 'i', 'believe', 'maam', 'i', 'may', 'safely', 'promise', 'you',
'never', 'to', 'dance', 'with', 'him', 'his', 'pride', 'said', 'miss', 'lucas',
'does', 'not', 'offend', 'me', 'so', 'much', 'as', 'pride', 'often', 'does',
'because', 'there', 'is', 'an', 'excuse', 'for', 'it', 'one', 'cannot',
'wonder', 'that', 'so', 'very', 'fine', 'a', 'young', 'man', 'with', 'family',
'fortune', 'everything', 'in', 'his', 'favour', 'should', 'think', 'highly',
'of', 'himself', 'if', 'i', 'may', 'so', 'express', 'it', 'he', 'has', 'a',
'right', 'to', 'be', 'proud', 'that', 'is', 'very', 'true', 'replied',
'elizabeth', 'and', 'i', 'could', 'easily', 'forgive', 'his', 'pride', 'if',
'he', 'had', 'not', 'mortified', 'mine', 'pride', 'observed', 'mary', 'who',
'piqued', 'herself', 'upon', 'the', 'solidity', 'of', 'her', 'reflections',
'is', 'a', 'very', 'common', 'failing', 'i', 'believe', 'by', 'all', 'that',
'i', 'have', 'ever', 'read', 'i', 'am', 'convinced', 'that', 'it', 'is', 'very',
'common', 'indeed', 'that', 'human', 'nature', 'is', 'particularly', 'prone',
'to', 'it', 'and', 'that', 'there', 'are', 'very', 'few', 'of', 'us', 'who',
'do', 'not', 'cherish', 'a', 'feeling', 'of', 'selfcomplacency', 'on', 'the',
'score', 'of', 'some', 'quality', 'or', 'other', 'real', 'or', 'imaginary',
'vanity', 'and', 'pride', 'are', 'different', 'things', 'though', 'the',
'words', 'are', 'often', 'used', 'synonymously', 'a', 'person', 'may', 'be',
'proud', 'without', 'being', 'vain', 'pride', 'relates', 'more', 'to', 'our',
'opinion', 'of', 'ourselves', 'vanity', 'to', 'what', 'we', 'would', 'have',
'others', 'think', 'of', 'us', 'if', 'i', 'were', 'as', 'rich', 'as', 'mr',
'darcy', 'cried', 'a', 'young', 'lucas', 'who', 'came', 'with', 'his',
'sisters', 'i', 'should', 'not', 'care', 'how', 'proud', 'i', 'was', 'i',
```

'would', 'keep', 'a', 'pack', 'of', 'foxhounds', 'and', 'drink', 'a', 'bottle',  
 'of', 'wine', 'a', 'day', 'then', 'you', 'would', 'drink', 'a', 'great', 'deal',  
 'more', 'than', 'you', 'ought', 'said', 'mrs', 'bennet', 'and', 'if', 'i',  
 'were', 'to', 'see', 'you', 'at', 'it', 'i', 'should', 'take', 'away', 'your',  
 'bottle', 'directly', 'the', 'boy', 'protested', 'that', 'she', 'should', 'not',  
 'she', 'continued', 'to', 'declare', 'that', 'she', 'would', 'and', 'the',  
 'argument', 'ended', 'only', 'with', 'the', 'visit', 'the', 'ladies', 'of',  
 'longbourn', 'soon', 'waited', 'on', 'those', 'of', 'netherfield', 'the',  
 'visit', 'was', 'soon', 'returned', 'in', 'due', 'form', 'miss', 'bennets',  
 'pleasing', 'manners', 'grew', 'on', 'the', 'goodwill', 'of', 'mrs', 'hurst',  
 'and', 'miss', 'bingley', 'and', 'though', 'the', 'mother', 'was', 'found',  
 'to', 'be', 'intolerable', 'and', 'the', 'younger', 'sisters', 'not', 'worth',  
 'speaking', 'to', 'a', 'wish', 'of', 'being', 'better', 'acquainted', 'with',  
 'them', 'was', 'expressed', 'towards', 'the', 'two', 'eldest', 'by', 'jane',  
 'this']

(b)

```
[2]: import collections
nKeep = 1000
word_count = collections.Counter(tok)
keep = [w for w,cnt in word_count.most_common(nKeep)] + ['?'];
tok2 = [t if t in keep else '?' for t in tok]
print(word_count.most_common(10),"\n")
print(tok2[5000:5400], "\n")
```

```
[('the', 4321), ('to', 4127), ('of', 3598), ('and', 3528), ('her', 2215), ('i',
2050), ('a', 1938), ('in', 1862), ('was', 1842), ('she', 1702)]
```

['to', 'the', 'ball', 'in', 'a', '?', '?', 'i', 'do', 'not', 'mind', 'his',  
 'not', 'talking', 'to', 'mrs', 'long', 'said', 'miss', 'lucas', 'but', 'i',  
 'wish', 'he', 'had', 'danced', 'with', 'eliza', 'another', 'time', 'lizzy',  
 'said', 'her', 'mother', 'i', 'would', 'not', 'dance', 'with', 'him', 'if', 'i',  
 'were', 'you', 'i', 'believe', '?', 'i', 'may', '?', 'promise', 'you', 'never',  
 'to', 'dance', 'with', 'him', 'his', 'pride', 'said', 'miss', 'lucas', 'does',  
 'not', '?', 'me', 'so', 'much', 'as', 'pride', 'often', 'does', 'because',  
 'there', 'is', 'an', 'excuse', 'for', 'it', 'one', 'cannot', 'wonder', 'that',  
 'so', 'very', 'fine', 'a', 'young', 'man', 'with', 'family', 'fortune',  
 'everything', 'in', 'his', 'favour', 'should', 'think', 'highly', 'of',  
 'himself', 'if', 'i', 'may', 'so', 'express', 'it', 'he', 'has', 'a', 'right',  
 'to', 'be', 'proud', 'that', 'is', 'very', 'true', 'replied', 'elizabeth',  
 'and', 'i', 'could', 'easily', '?', 'his', 'pride', 'if', 'he', 'had', 'not',  
 '?', 'mine', 'pride', 'observed', 'mary', 'who', '?', 'herself', 'upon', 'the',  
 '?', 'of', 'her', '?', 'is', 'a', 'very', 'common', '?', 'i', 'believe', 'by',  
 'all', 'that', 'i', 'have', 'ever', 'read', 'i', 'am', 'convinced', 'that',  
 'it', 'is', 'very', 'common', 'indeed', 'that', '?', 'nature', 'is',  
 'particularly', '?', 'to', 'it', 'and', 'that', 'there', 'are', 'very', 'few',  
 'of', 'us', 'who', 'do', 'not', '?', 'a', 'feeling', 'of', '?', 'on', 'the',  
 '?', 'of', 'some', '?', 'or', 'other', 'real', 'or', '?', 'vanity', 'and',

'pride', 'are', 'different', 'things', 'though', 'the', 'words', 'are', 'often',  
 'used', '?', 'a', 'person', 'may', 'be', 'proud', 'without', 'being', 'vain',  
 'pride', '?', 'more', 'to', 'our', 'opinion', 'of', '?', 'vanity', 'to', 'what',  
 'we', 'would', 'have', 'others', 'think', 'of', 'us', 'if', 'i', 'were', 'as',  
 '?', 'as', 'mr', 'darcy', 'cried', 'a', 'young', 'lucas', 'who', 'came', 'with',  
 'his', 'sisters', 'i', 'should', 'not', 'care', 'how', 'proud', 'i', 'was', 'i',  
 'would', 'keep', 'a', '?', 'of', '?', 'and', '?', 'a', '?', 'of', '?', 'a',  
 'day', 'then', 'you', 'would', '?', 'a', 'great', 'deal', 'more', 'than', 'you',  
 'ought', 'said', 'mrs', 'bennet', 'and', 'if', 'i', 'were', 'to', 'see', 'you',  
 'at', 'it', 'i', 'should', 'take', 'away', 'your', '?', 'directly', 'the', '?',  
 '?', 'that', 'she', 'should', 'not', 'she', 'continued', 'to', '?', 'that',  
 'she', 'would', 'and', 'the', '?', '?', 'only', 'with', 'the', 'visit', 'the',  
 'ladies', 'of', 'longbourn', 'soon', '?', 'on', 'those', 'of', 'netherfield',  
 'the', 'visit', 'was', 'soon', 'returned', 'in', '?', 'form', 'miss', 'bennets',  
 'pleasing', 'manners', '?', 'on', 'the', '?', 'of', 'mrs', 'hurst', 'and',  
 'miss', 'bingley', 'and', 'though', 'the', 'mother', 'was', 'found', 'to', 'be',  
 '?', 'and', 'the', 'younger', 'sisters', 'not', 'worth', 'speaking', 'to', 'a',  
 'wish', 'of', 'being', 'better', 'acquainted', 'with', 'them', 'was',  
 'expressed', 'towards', 'the', 'two', 'eldest', 'by', 'jane', 'this']

(c)

```
[5]: import numpy as np
import pandas as pd
t_matrix = np.zeros((1001,1001))
for i in range(1,len(tok2)):
    t_matrix[keep.index(tok2[i-1])][keep.index(tok2[i])]+=1
for i in range(0, 1001):
    sum_i = np.sum(t_matrix[i])
    for j in range(0,1001):
        t_matrix[i][j] = t_matrix[i][j]/sum_i
miss = np.argsort(t_matrix[keep.index('miss')])[-5:][::-1]
for i in range(0,len(miss)):
    print(keep[miss[i]], t_matrix[keep.index('miss')][miss[i]])
```

bingley 0.254416961130742  
 bennet 0.21201413427561838  
 darcy 0.12014134275618374  
 lucas 0.0812720848056537  
 de 0.0706713780918728

(d)

```
[6]: def BS_generator(matrix, word, length = 50):
    BS = word
    for i in range(1, length):
        word = np.random.choice(keep, p=matrix[keep.index(word)])
        BS = " ".join([BS,word])
```

```

    return BS
bs1 = BS_generator(t_matrix, 'miss')
print(bs1)
bs2 = BS_generator(t_matrix, 'miss')
print(bs2)
bs3 = BS_generator(t_matrix, 'miss')
print(bs3)

```

miss bingley called on ? their ? of her hand jane recollected having ? ? manners she must marry for her longbourn estate should think of ? himself and do nothing she was he to her known that it and soon ? at his friend of speaking which they had

miss bingley said charlotte assured her to make her mother in this is to hunsford parsonage and ? certainly cried mr darcy after everybody ? upon yourself i was its being at her ? of them both and was ? had not janes is to know it a pause added

miss de bourgh and miss bennets ? should but jane oh how far as i could not ? and ? the ? there is your reason i do their ? on the hope of feeling all the eyes how much mistaken for the table where they might have heard so