

MUCH ADO ABOUT NOTHING:
THE MANY RAMBLINGS OF A GRAD STUDENT

By
MY NAME HERE

Bachelor of Science in Physics
University of North Texas
Denton, Texas
1993

Master of Science in Systems Engineering
Missouri University of Science and Technology
Rolla, Missouri
2012

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Dissertation Approved:

My Advisor

Dissertation Adviser

Member One

Member Two

Member Three

Member Outside

ACKNOWLEDGEMENTS

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Acknowledgements reflect the views of the author and are not endorsed by committee members or Oklahoma State University.

Name: MY NAME HERE

Date of Degree: MAY, 2028

Title of Study: MUCH ADO ABOUT NOTHING: THE MANY RAMBLINGS OF
A GRAD STUDENT

Major Field: COMPUTER SCIENCE

Abstract: Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa. Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

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CHAPTER I

THE FIRST CHAPTER WHICH HAS AN INCREDIBLY, INCREDIBLY, INCREDIBLY, INCREDIBLY, INCREDIBLY, LONG TITLE

1.1 The first section which has an incredibly, incredibly, incredibly, incredibly, incredibly, long title

1.1.1 The first subsection which has an incredibly, incredibly, incredibly, incredibly, incredibly, long title

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit

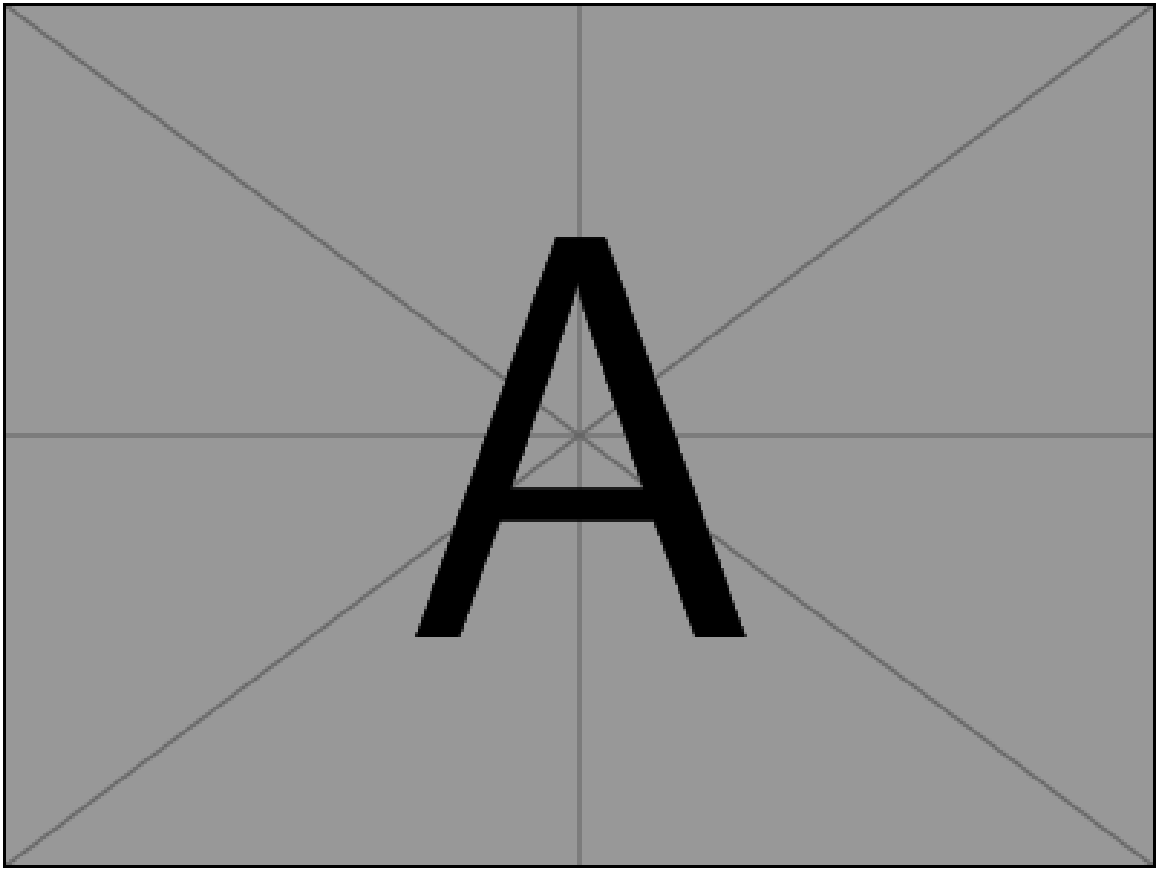


Figure 1.1 Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio. (See Figure 1.1.)

1.1.2 Second subsection

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis

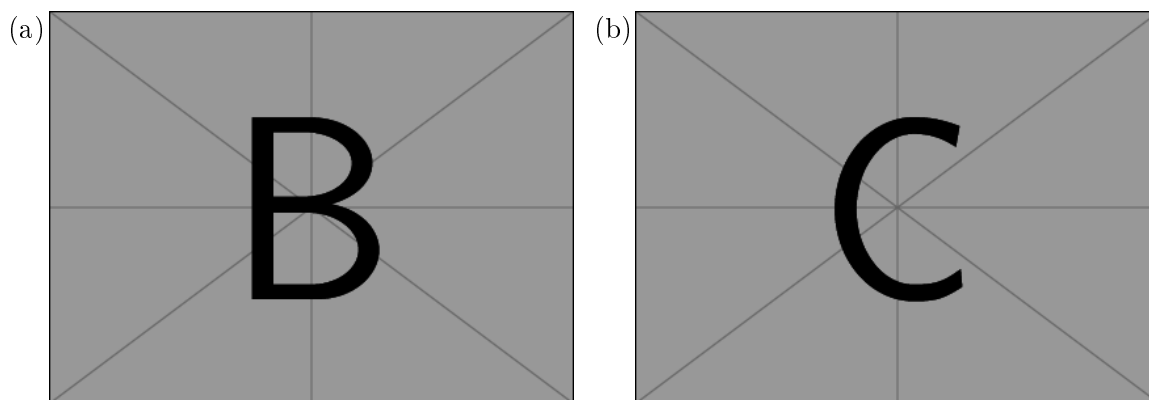


Figure 1.2 (a) The letter “B”. (b) The letter “C”.

egestas. Donec odio elit, dictum in, hendrerit sit amet, egestas sed, leo. Praesent feugiat sapien aliquet odio. Integer vitae justo. Aliquam vestibulum fringilla lorem. Sed neque lectus, consectetur at, consectetur sed, eleifend ac, lectus. Nulla facilisi. Pellentesque eget lectus. Proin eu metus. Sed porttitor. In hac habitasse platea dictumst. Suspendisse eu lectus. Ut mi mi, lacinia sit amet, placerat et, mollis vitae, dui. Sed ante tellus, tristique ut, iaculis eu, malesuada ac, dui. Mauris nibh leo, facilisis non, adipiscing quis, ultrices a, dui.¹

1.2 Second section

Morbi luctus, wisi viverra faucibus pretium, nibh est placerat odio, nec commodo wisi enim eget quam. Quisque libero justo, consectetur a, feugiat vitae, porttitor eu, libero. Suspendisse sed mauris vitae elit sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque sit amet pede ac sem eleifend consectetur. Nullam elementum,

¹This can be seen in Figure 1.2 (a) and (b).

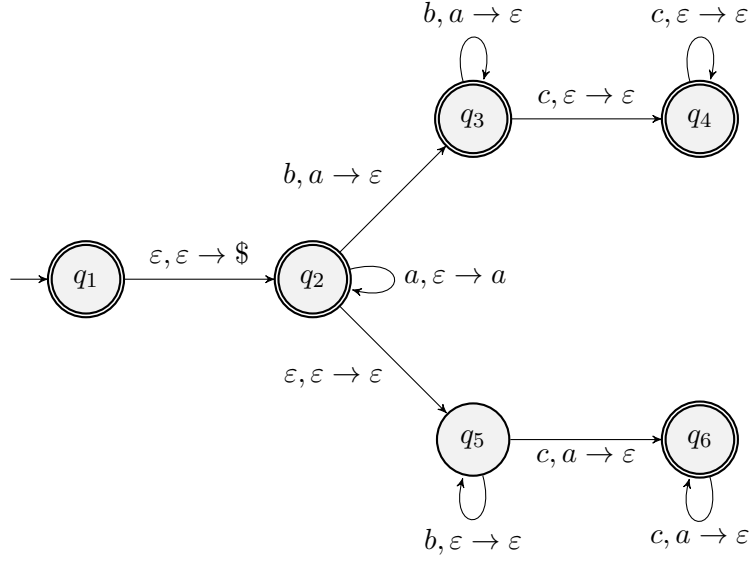


Figure 1.3 Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

urna vel imperdiet sodales, elit ipsum pharetra ligula, ac pretium ante justo a nulla.

Curabitur tristique arcu eu metus. Vestibulum lectus. Proin mauris. Proin eu nunc eu

urna hendrerit faucibus. Aliquam auctor, pede consequat laoreet varius, eros tellus

scelerisque quam, pellentesque hendrerit ipsum dolor sed augue. Nulla nec lacus. (Wombat

and Koala 2016, Lion, Giraffe, and Capybara 2010) This can be seen in Figure 1.3.

1.3 Third section

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu.

Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel,

nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu

purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio. This can be seen in Algorithm 1.1. Suspendisse vel felis. Ut lorem lorem,

Algorithm 1.1 Euclid's algorithm

```

1: procedure EUCLID( $a, b$ )                                ▷ The g.c.d. of  $a$  and  $b$ 
2:    $r \leftarrow a \bmod b$ 
3:   while  $r \neq 0$  do                                     ▷ We have the answer if  $r$  is 0
4:      $a \leftarrow b$ 
5:      $b \leftarrow r$ 
6:      $r \leftarrow a \bmod b$ 
7:   end while
8:   return  $b$                                              ▷ The g.c.d. is  $b$ 
9: end procedure

```

interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante.

Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

CHAPTER II

SECOND

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

2.1 First section

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

Table 2.1 Aliquam lectus. Vivamus leo. Quisque ornare tellus ullamcorper nulla. Mauris porttitor pharetra tortor. Sed fringilla justo sed mauris. Mauris tellus. Sed non leo. Nullam elementum, magna in cursus sodales, augue est scelerisque sapien, venenatis congue nulla arcu et pede. Ut suscipit enim vel sapien. Donec congue. Maecenas urna mi, suscipit in, placerat ut, vestibulum ut, massa. Fusce ultrices nulla et nisl.

Orc	LVL	LDR	ATT	DEF	INI	SPD	HP	DMG
Goblin	2	35	16	10	4	2	20	2–4
Furious Goblin	2	40	14	14	6	3	38	3–8
Orc	3	60	16	17	4	2	65	7–10
Catapult	3	120	33	15	4	2	80	5–9
Veteran Orc	4	140	25	25	6	3	110	15–20
Shaman	4	200	24	32	5	3	160	15–18

Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetur eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.^{1,2}

2.2 Second section

2.2.1 First subsection

Etiam ac leo a risus tristique nonummy. Donec dignissim tincidunt nulla. Vestibulum rhoncus molestie odio. Sed lobortis, justo et pretium lobortis, mauris turpis condimentum

¹This can be seen in Table 2.1.

²Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetur tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut, mi. Duis nec dui quis leo sagittis commodo.

Table 2.2 Values relating to Fourier transforms.

m	$\Re\{\mathfrak{X}(m)\}$	$-\Im\{\mathfrak{X}(m)\}$	$\mathfrak{X}(m)$	$\frac{\mathfrak{X}(m)}{23}$	A_m	$\varphi(m) / ^\circ$	$\varphi_m / ^\circ$
1	16.128	8.872	16.128	1.402	1.373	-146.600	-137.600
2	3.442	-2.509	3.442	0.299	0.343	133.200	152.400
3	1.826	-0.363	1.826	0.159	0.119	168.500	-161.100
4	0.993	-0.429	0.993	0.086	0.080	25.600	90
5	1.290	0.099	1.290	0.112	0.097	-175.600	-114.700
6	0.483	-0.183	0.483	0.042	0.063	22.300	122.500
7	0.766	-0.475	0.766	0.067	0.039	141.600	-122
8	0.624	0.365	0.624	0.054	0.040	-35.700	90
9	0.641	-0.466	0.641	0.056	0.045	133.300	-106.300
10	0.450	0.421	0.450	0.039	0.034	-69.400	110.900
11	0.598	-0.597	0.598	0.052	0.025	92.300	-109.300

augue, nec ultricies nibh arcu pretium enim. Nunc purus neque, placerat id, imperdiet sed, pellentesque nec, nisl. Vestibulum imperdiet neque non sem accumsan laoreet. In hac habitasse platea dictumst. Etiam condimentum facilisis libero. Suspendisse in elit quis nisl aliquam dapibus. Pellentesque auctor sapien. Sed egestas sapien nec lectus. Pellentesque vel dui vel neque bibendum viverra. Aliquam porttitor nisl nec pede. Proin mattis libero vel turpis. Donec rutrum mauris et libero. Proin euismod porta felis. Nam lobortis, metus quis elementum commodo, nunc lectus elementum mauris, eget vulputate ligula tellus eu neque. Vivamus eu dolor. (See Table 2.2.)

2.2.2 Second subsection

Nulla in ipsum. Praesent eros nulla, congue vitae, euismod ut, commodo a, wisi. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Aenean nonummy magna non leo. Sed felis erat, ullamcorper in, dictum non, ultricies ut, lectus. Proin vel arcu a odio lobortis euismod. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Proin ut est. Aliquam odio. Pellentesque massa turpis, cursus eu, euismod nec, tempor congue, nulla. Duis viverra gravida mauris. Cras tincidunt. Curabitur eros ligula, varius ut, pulvinar in, cursus

faucibus, auge.

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APPENDIX A

THE FIRST APPENDIX WHICH HAS AN INCREDIBLY, INCREDIBLY, INCREDIBLY, INCREDIBLY, INCREDIBLY, LONG TITLE

A.1 The first section which has an incredibly, incredibly, incredibly, incredibly, incredibly,
long title

A.1.1 The first subsection which has an incredibly, incredibly, incredibly, incredibly,
incredibly, long title

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper,
leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam
pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros
eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla
facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum,
justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus.
Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo.
Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu.
Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel,
nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu
purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit

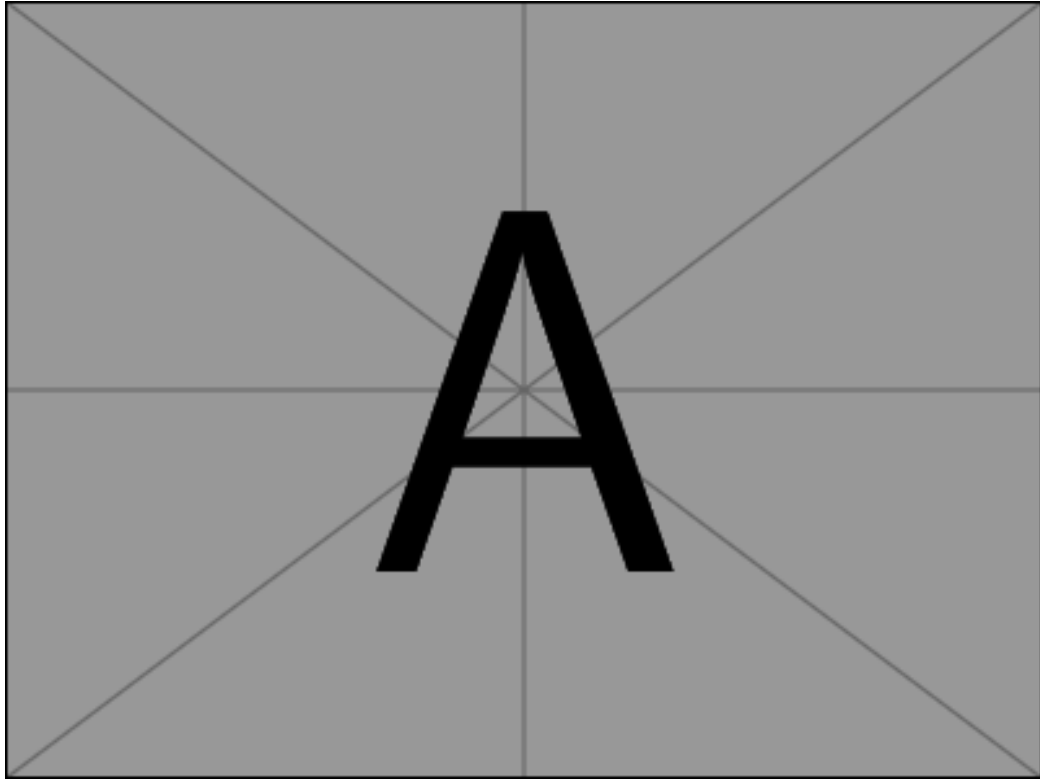


Figure A.1 Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio. (See Figure A.1.)

A.1.2 Second subsection

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Donec odio elit, dictum in, hendrerit sit amet, egestas sed, leo. Praesent feugiat

sapien aliquet odio. Integer vitae justo. Aliquam vestibulum fringilla lorem. Sed neque lectus, consectetur at, consectetur sed, eleifend ac, lectus. Nulla facilisi. Pellentesque eget lectus. Proin eu metus. Sed porttitor. In hac habitasse platea dictumst. Suspendisse eu lectus. Ut mi mi, lacinia sit amet, placerat et, mollis vitae, dui. Sed ante tellus, tristique ut, iaculis eu, malesuada ac, dui. Mauris nibh leo, facilisis non, adipiscing quis, ultrices a, dui.¹

A.2 Second section

Morbi luctus, wisi viverra faucibus pretium, nibh est placerat odio, nec commodo wisi enim eget quam. Quisque libero justo, consectetur a, feugiat vitae, porttitor eu, libero. Suspendisse sed mauris vitae elit sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque sit amet pede ac sem eleifend consectetur. Nullam elementum, urna vel imperdiet sodales, elit ipsum pharetra ligula, ac pretium ante justo a nulla. Curabitur tristique arcu eu metus. Vestibulum lectus. Proin mauris. Proin eu nunc eu urna hendrerit faucibus. Aliquam auctor, pede consequat laoreet varius, eros tellus scelerisque quam, pellentesque hendrerit ipsum dolor sed augue. Nulla nec lacus. (*Generating Bibliographies with biblatex and biber* 2016)

¹This can be seen in Figure A.2 (a) and (b) and in Figure A.3 (a), (b), and (c) and in Figure A.4 (a), (b), (c), and (d) and in Figure A.5 (a), (b), (c), (d), (e), and (f).

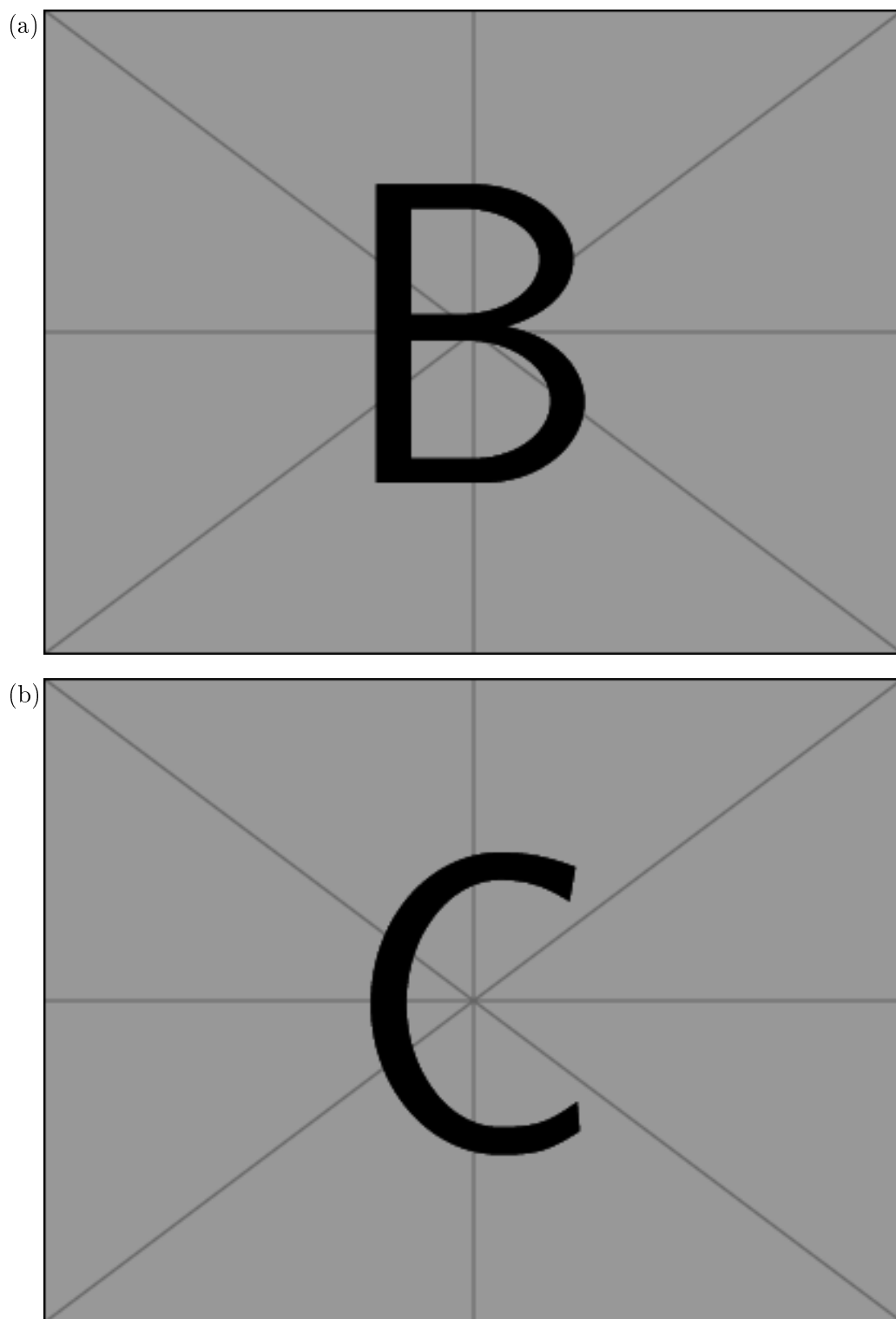


Figure A.2 (a) The letter “B”. (b) The letter “C”.

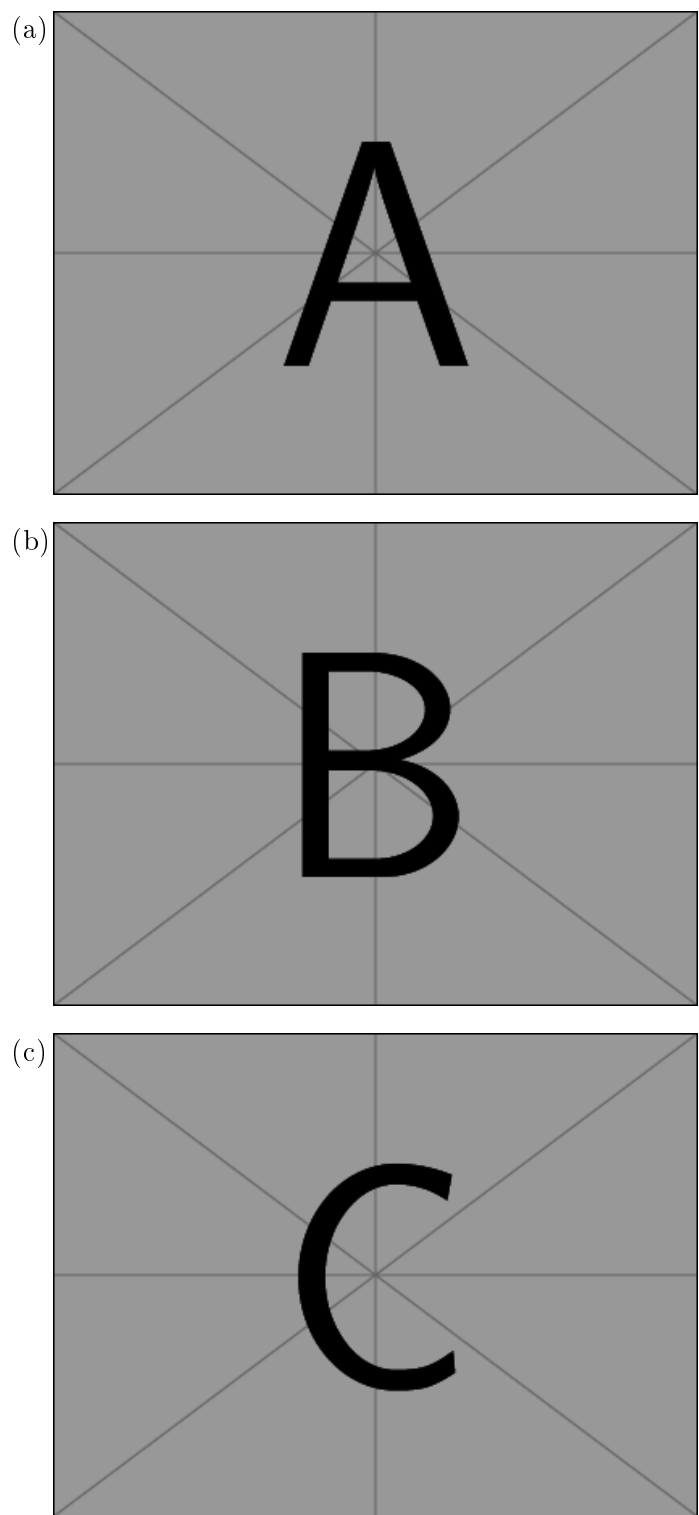


Figure A.3 (a) The letter “A”. (b) The letter “B”. (c) The letter “C”.

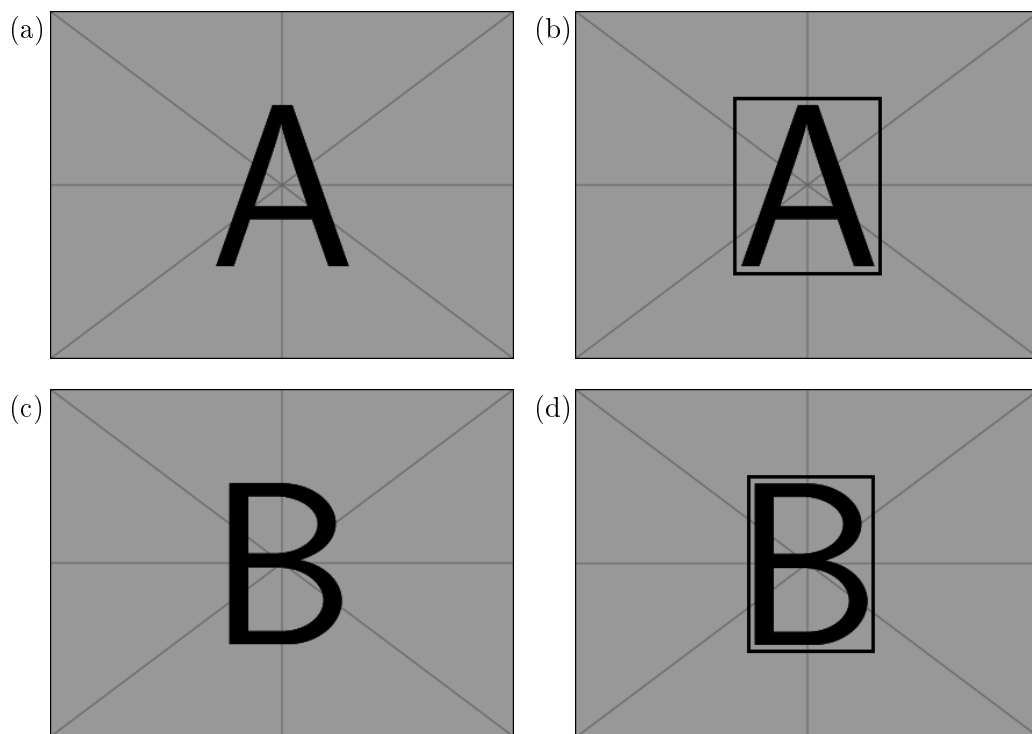


Figure A.4 (a) The letter “A”. (b) The letter “A” boxed. (c) The letter “B”. (d) The letter “B” boxed.

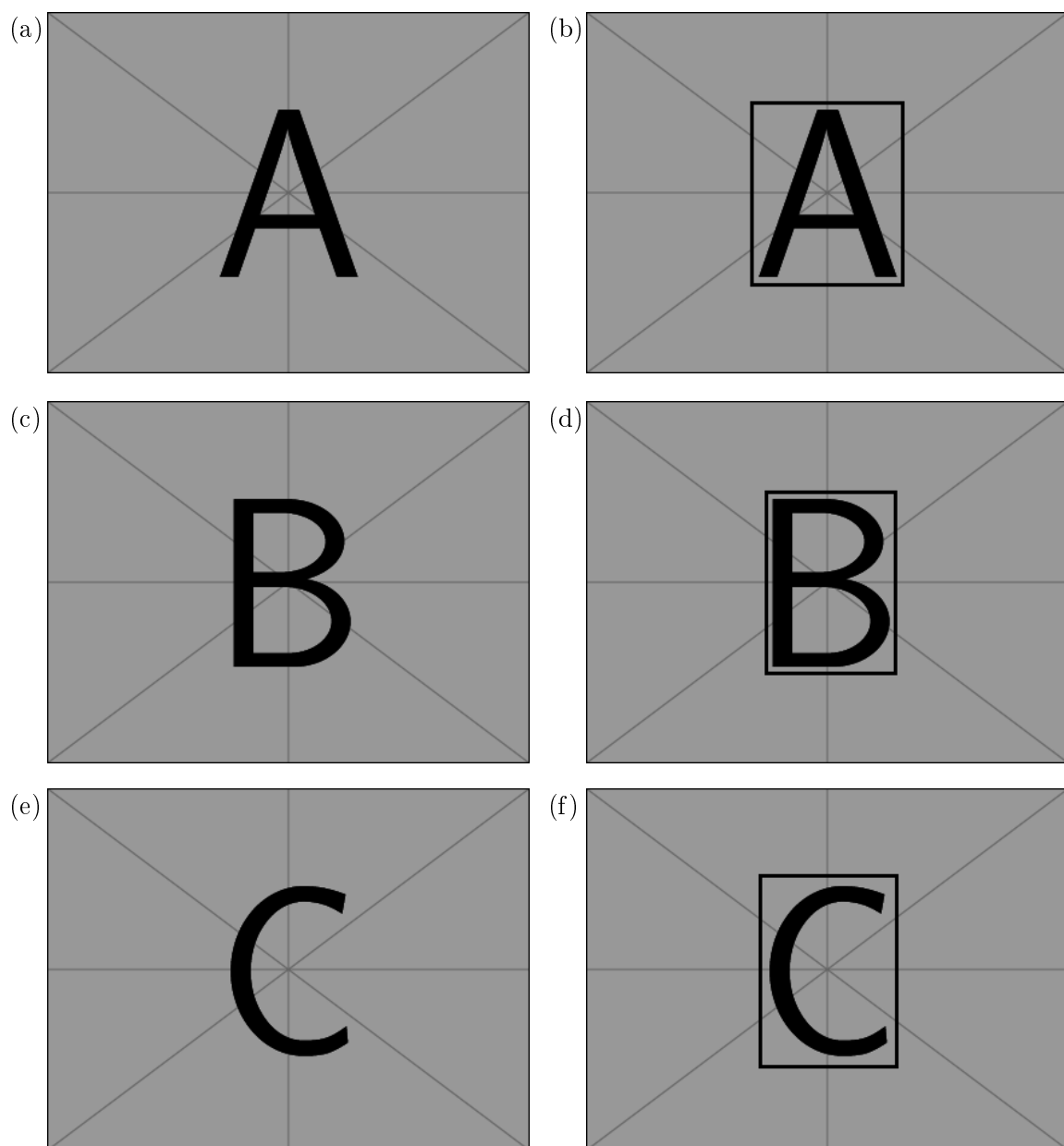


Figure A.5 (a) The letter “A” on a gray mat and dark lines. (b) The letter “A” boxed on a gray mat and dark lines. (c) The letter “B” on a gray mat and dark lines. (d) The letter “B” boxed on a gray mat and dark lines. (e) The letter “C” on a gray mat and dark lines. (f) The letter “C” boxed on a gray mat and dark lines.

APPENDIX B

SECOND APPENDIX

B.1 First section

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetur eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.^{1,2}

¹This can be seen in Table B.1.

²Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetur tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut,

Table B.1 Aliquam lectus. Vivamus leo. Quisque ornare tellus ullamcorper nulla. Mauris porttitor pharetra tortor. Sed fringilla justo sed mauris. Mauris tellus. Sed non leo. Nullam elementum, magna in cursus sodales, augue est scelerisque sapien, venenatis congue nulla arcu et pede. Ut suscipit enim vel sapien. Donec congue. Maecenas urna mi, suscipit in, placerat ut, vestibulum ut, massa. Fusce ultrices nulla et nisl.

Orc	LVL	LDR	ATT	DEF	INI	SPD	HP	DMG
Goblin	2	35	16	10	4	2	20	2–4
Furious Goblin	2	40	14	14	6	3	38	3–8
Orc	3	60	16	17	4	2	65	7–10
Catapult	3	120	33	15	4	2	80	5–9
Veteran Orc	4	140	25	25	6	3	110	15–20
Shaman	4	200	24	32	5	3	160	15–18

Table B.2 Values relating to Fourier transforms.

m	$\Re\{\mathfrak{X}(m)\}$	$-\Im\{\mathfrak{X}(m)\}$	$\mathfrak{X}(m)$	$\frac{\mathfrak{X}(m)}{23}$	A_m	$\varphi(m) / ^\circ$	$\varphi_m / ^\circ$
1	16.128	8.872	16.128	1.402	1.373	−146.600	−137.600
2	3.442	−2.509	3.442	0.299	0.343	133.200	152.400
3	1.826	−0.363	1.826	0.159	0.119	168.500	−161.100
4	0.993	−0.429	0.993	0.086	0.080	25.600	90
5	1.290	0.099	1.290	0.112	0.097	−175.600	−114.700
6	0.483	−0.183	0.483	0.042	0.063	22.300	122.500
7	0.766	−0.475	0.766	0.067	0.039	141.600	−122
8	0.624	0.365	0.624	0.054	0.040	−35.700	90
9	0.641	−0.466	0.641	0.056	0.045	133.300	−106.300
10	0.450	0.421	0.450	0.039	0.034	−69.400	110.900
11	0.598	−0.597	0.598	0.052	0.025	92.300	−109.300

B.2 Second section

B.2.1 First subsection

Etiam ac leo a risus tristique nonummy. Donec dignissim tincidunt nulla. Vestibulum rhoncus molestie odio. Sed lobortis, justo et pretium lobortis, mauris turpis condimentum augue, nec ultricies nibh arcu pretium enim. Nunc purus neque, placerat id, imperdiet sed, mi. Duis nec dui quis leo sagittis commodo.

pellentesque nec, nisl. Vestibulum imperdiet neque non sem accumsan laoreet. In hac habitasse platea dictumst. Etiam condimentum facilisis libero. Suspendisse in elit quis nisl aliquam dapibus. Pellentesque auctor sapien. Sed egestas sapien nec lectus. Pellentesque vel dui vel neque bibendum viverra. Aliquam porttitor nisl nec pede. Proin mattis libero vel turpis. Donec rutrum mauris et libero. Proin euismod porta felis. Nam lobortis, metus quis elementum commodo, nunc lectus elementum mauris, eget vulputate ligula tellus eu neque. Vivamus eu dolor. (See Table B.2.)

B.2.2 Second subsection

Nulla in ipsum. Praesent eros nulla, congue vitae, euismod ut, commodo a, wisi. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Aenean nonummy magna non leo. Sed felis erat, ullamcorper in, dictum non, ultricies ut, lectus. Proin vel arcu a odio lobortis euismod. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Proin ut est. Aliquam odio. Pellentesque massa turpis, cursus eu, euismod nec, tempor congue, nulla. Duis viverra gravida mauris. Cras tincidunt. Curabitur eros ligula, varius ut, pulvinar in, cursus faucibus, augue.

APPENDIX C

SOURCE CODE

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetur eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.^{1,2}

¹This can be seen in Listing C.1 and Listing C.2 and in Algorithm C.1.

²Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetur tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut, mi. Duis nec dui quis leo sagittis commodo.

Listing C.1 R code for producing CIAO plots.

```

# Create CIAO plot from x.
# x should be a data frame defining the indices and values of an
# upper triangular matrix where the first column consists of the
# first indices, the second column consists of the second
5 # indices, and the third column consists of the values.
CIAOplot <- function(
    x,
    na.rm = TRUE,
    col = gray.colors(50, start = 0.0, end = 0.95, gamma = 2.2,
    ↪ alpha = NULL),
10    margins = c(4, 4),
    main = NULL,
    xlab = NULL,
    ylab = NULL) {
    # Compute matrix dimensions from number of elements in the
    # upper triangular matrix.
15    n <- (sqrt(8 * nrow(x) + 1) - 1) / 2

    # Create matrices from data frame
    M <- matrix(NA, nrow = n, ncol = n)
20    for (i in 1:nrow(x)) {
        M[x[i,1], x[i,2]] = x[i,3]
    }

    # Condition matrix assuming maximization problem
25    N <- max(M, na.rm = na.rm) - M
    NMin <- min(N, na.rm = na.rm)
    NMax <- max(N, na.rm = na.rm)
    M <- (N - NMin) / (NMax - NMin)

    # Generate CIAO plot
30    heatmap(M, Rowv = NA, Colv = NA, scale = "none", na.rm = na.rm,
    ↪ col = col, margins = margins, main = main, xlab = xlab,
    ↪ ylab = ylab)
}

```

Listing C.2 Python code for reproducing results.

```

import numpy as np
import matplotlib.pyplot as plt
import matplotlib as mpl

5 from brian2 import *

epsilon = 1.0e-6

showGaussian = False
10 showPoisson = False
showNoise = False

# =====

15 def LinePlot(start, stop, step, f, xUnits, yUnits, *args, **kwargs):
    x = []
    y = []
    xEpsilon = epsilon * xUnits
    yEpsilon = epsilon * yUnits
    20 xRange = np.arange(start, stop, step)
    for xp in xRange:
        yp = f(xp)
        if len(x) == 0 or abs(xp - xRange[-1]) < xEpsilon:
            x.append(xp / xUnits)
            y.append(yp / yUnits)
        25 elif abs(yp - y[-1] * yUnits) > yEpsilon:
            if abs(xpp - x[-1] * xUnits) > xEpsilon:
                x.append(xpp / xUnits)
                y.append(ypp / yUnits)
            x.append(xp / xUnits)
            y.append(yp / yUnits)
        30 xpp = xp
        ypp = yp
    plt.plot(x, y, *args, **kwargs)
    35 # =====

    if __name__ == "__main__":
        40 print("=== Initialization ===")
        start_scope()

```

```

# Simulation parameters
simTime = 4*second
activeTime = 2*second
defaultclock.dt = 0.05*ms
ratePeriod = 50*ms
NA = 800
NB = 800
mu0 = 40.0
sigma = 10.0
coherence = 0.064

# Derived values
muA = mu0 * (1.0 + coherence)
muB = mu0 * (1.0 - coherence)
print("N = {}, muA = {}, muB = {}, sigma = {}".format(NA+NB,
    ↪ muA, muB, sigma))

# =====
# Create time-dependent Poisson rates for inputs to A and B
# =====
# Calculate number of rate bins in active time period
activeRateBins = int(activeTime / ratePeriod + 0.5)
# Create rates with Gaussian distribution
gaussianA = np.random.normal(muA, sigma, activeRateBins)
gaussianB = np.random.normal(muB, sigma, activeRateBins)
# Calculate number of rate bins in each inactive time period,
# assuming inactive time periods equally precede and follow
# the active time period.
inactiveTimeHalf = int(0.5 * (simTime - activeTime) +
    ↪ 0.5*second) * second
inactiveRatePeriods = int(inactiveTimeHalf / ratePeriod + 0.5)
ratesA = [0.0] * inactiveRatePeriods
ratesA.extend(gaussianA)
ratesA.extend([0.0] * inactiveRatePeriods)
ratesB = [0.0] * inactiveRatePeriods
ratesB.extend(gaussianB)
ratesB.extend([0.0] * inactiveRatePeriods)
# Time-dependencies must be defined using TimedArrays
timedRatesA = TimedArray(ratesA * Hz, dt=ratePeriod)
timedRatesB = TimedArray(ratesB * Hz, dt=ratePeriod)
print("Poisson spikes generated.")
# Show plot of rates if desired
if showGaussian:

```



```

LinePlot(0.0*ms, simTime, defaultclock.dt, timedRatesA, ms,
↪ Hz, "r", label = "A")
85 LinePlot(0.0*ms, simTime, defaultclock.dt, timedRatesB, ms,
↪ Hz, "b", label = "B")
yMin, yMax = plt.ylim()
plt.ylim(bottom = min(0.0, yMin), top = max(2 * mu0, yMax))
plt.xlabel("Time (ms)")
plt.ylabel("Sample stimulus")
90 plt.legend()
plt.show()

# =====
# Create spikes used for inputs to A and B
95 # =====
# Create spikes by applying Poisson rates to Poisson generator
PGA = PoissonGroup(NA, rates="timedRatesA(t)")
PGB = PoissonGroup(NB, rates="timedRatesB(t)")
MPGA = SpikeMonitor(PGA)
100 MPGB = SpikeMonitor(PGB)
netA = Network(PGA, MPGA)
netB = Network(PGB, MPGB)
netA.run(simTime)
spikesA_i = MPGA.i
105 spikesA_t = MPGA.t
netB.run(simTime)
spikesB_i = MPGB.i
spikesB_t = MPGB.t
# Capture spikes
110 SGGA = SpikeGeneratorGroup(NA, spikesA_i, spikesA_t)
SGBB = SpikeGeneratorGroup(NB, spikesB_i, spikesB_t)
# Plot spikes if desired
if showPoisson:
    plt.subplot(1, 2, 1)
    115 plt.plot(spikesA_i, spikesA_t / ms, "r.")
    yMin, yMax = plt.ylim()
    plt.ylim(bottom=min(0.0, yMin), top=max(simTime / ms, yMax))
    plt.title("A")
    plt.xlabel("Output index")
    plt.ylabel("Spike time (ms)")
    120 plt.subplot(1, 2, 2)
    plt.plot(spikesB_i, spikesB_t / ms, "b.")
    yMin, yMax = plt.ylim()
    plt.ylim(bottom=min(0.0, yMin), top=max(simTime / ms, yMax))
    125 plt.title("B")
    plt.xlabel("Output index")

```

```

plt.ylabel("Spike time (ms)")
plt.show()

# =====
# Define pyramidal equation and parameters
# =====
Cm = 0.5*nfarad
gL = 25*nS
vL = -70*mV
tauR = gL/Cm
sigmaNoise = 0.0086*volt*siemens/farad # 3 Hz mean noise
eqPyramidal = """
dv/dt = tauR*(vL-v) + sigmaNoise*sqrt(2*tauR)*xi/Hz : volt
    ↪ (unless refractory)
"""

# =====
# Define synapse parameters
# =====
w_stim = 0.8*mV
w_rec = 0.016*mV
w_inh = 0.016*mV

# =====
# Calculate noise statistics
# =====
# Create and run isolated network of neurons with no stimulus
Nnoise = 50
NGnoise = NeuronGroup(Nnoise, eqPyramidal, threshold = "v >
    ↪ -50*mV", reset = "v = -55*mV", refractory = 2*ms, method
    ↪ = "euler")
NGnoise.v = -55*mV
MNGnoise = SpikeMonitor(NGnoise)
netnoise = Network(NGnoise, MNGnoise)
netnoise.run(simTime)
trains = MNGnoise.spike_trains()
# Calculate period of time between spikes
periods = []
for train in list(trains.values()):
    if len(train) > 0:
        period = [train[0]/ms]
        i = 1
        while i < len(train):
            period.append((train[i] - train[i - 1])/ms)
            i += 1

```

```

        periods.append(period)
170 # Calculate statistics
print()
print("=== Noise Statistics =====")
print("Percent of neurons exhibiting noise: {:.0f}".format(100 *
    ↪ len(periods) / Nnoise))
means = []
175 stddevs = []
for period in periods:
    mean = sum(period) / len(period)
    stddev = (sum([(x - mean) ** 2] for x in period]) /
    ↪ len(period)) ** 0.5
    means.append(mean)
180 stddevs.append(stddev)
if len(means) > 0:
    meanmean = sum(means) / len(means)
    meanstddev = sum(stddevs) / len(stddevs)
    stddevmean = (sum([(x - meanmean) ** 2] for x in means)) /
    ↪ len(means)) ** 0.5
185 print("Noise: Mean of means = {:.0f} ms, StdDev of means =
    ↪ {:.0f} ms, Mean StdDev = {:.0f} ms".format(meanmean,
    ↪ stddevmean, meanstddev))
if showNoise:
    plt.plot(MNGnoise.i, MNGnoise.t / ms, "b.")
    yMin, yMax = plt.ylim()
    plt.ylim(bottom=min(0, yMin), top=max(simTime/ms, yMax))
190 plt.xlabel("Neuron index")
plt.ylabel("Spike time (ms)")
plt.show()

print()
195 print("=== Simulation =====")
# Cortical group A
NGA = NeuronGroup(NA, eqPyramidal, threshold = "v > -50*mV",
    ↪ reset = "v = -55*mV", refractory = 2*ms, method =
    ↪ "euler")
NGA.v = -55*mV
SAstim = Synapses(SGGA, NGA, on_pre = "v += w_stim")
200 SAstim.connect(p=0.15)
SArec = Synapses(NGA, NGA, on_pre = "v += w_rec")
SArec.connect()
MNGA = SpikeMonitor(NGA)
NGB = NeuronGroup(NB, eqPyramidal, threshold = "v > -50*mV",
    ↪ reset = "v = -55*mV", refractory = 2*ms, method =
    ↪ "euler")

```

```

205 NGB.v = -55*mV
SBstim = Synapses(SGGB, NGB, on_pre = "v += w_stim")
SBstim.connect(p=0.15)
SBrec = Synapses(NGB, NGB, on_pre = "v += w_rec")
SBrec.connect()
210 MNGB = SpikeMonitor(NGB)
SAinh = Synapses(NGB, NGA, on_pre = "v -= w_inh")
SAinh.connect()
SBinh = Synapses(NGA, NGB, on_pre = "v -= w_inh")
SBinh.connect()
215 netAB = Network(SGGA, NGA, SGGB, NGB, SAstim, SAre, SAinh,
    ↪ SBstim, SBrec, SBinh, MNGA, MNGB)
netAB.run(simTime)

print("Simulation finished.")
fig, (ax1, ax2) = plt.subplots(1, 2, figsize = (12,5))
220 fig.suptitle("Pyramidal Cells")
ax1.plot(MNGA.i, MNGA.t / ms, "r.")
ax2.plot(MNGB.i, MNGB.t / ms, "b.")
ax1.set_title("A", color = "r")
ax2.set_title("B", color = "b")
225 yMin1, yMax1 = ax1.get_ylim()
yMin2, yMax2 = ax2.get_ylim()
ax1.set_ylim(bottom = min(0, min(yMin1, yMin2)), top =
    ↪ max(simTime/ms, max(yMax1, yMax2)))
ax2.set_ylim(bottom = min(0, min(yMin1, yMin2)), top =
    ↪ max(simTime/ms, max(yMax1, yMax2)))
for ax in fig.get_axes():
230 ax.set(xlabel = "Neuron index", ylabel = "Spike time (ms)")
for ax in fig.get_axes():
    ax.label_outer()
plt.subplots_adjust(left = 0.1, right = 0.94, top = 0.86,
    ↪ bottom = 0.14, wspace = 0.1, hspace = 0.2)
plt.show()

```

C.3 Third section

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel,

nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio. Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet

Algorithm C.1 Euclid's algorithm

```

1: procedure EUCLID( $a, b$ )                                ▷ The g.c.d. of  $a$  and  $b$ 
2:    $r \leftarrow a \bmod b$ 
3:   while  $r \neq 0$  do                                     ▷ We have the answer if  $r$  is 0
4:      $a \leftarrow b$ 
5:      $b \leftarrow r$ 
6:      $r \leftarrow a \bmod b$ 
7:   end while
8:   return  $b$                                              ▷ The g.c.d. is  $b$ 
9: end procedure

```

vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

My Name Here

Candidate for the Degree of

Doctor of Philosophy

Thesis: MUCH ADO ABOUT NOTHING: THE MANY RAMBLINGS OF A
GRAD STUDENT

Major Field: Computer Science

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Computer
Science at Oklahoma State University, Stillwater, Oklahoma in May, 2028.

Completed the requirements for the Master of Science in Systems
Engineering at Missouri University of Science and Technology, Rolla,
Missouri in May, 2012.

Completed the requirements for the Bachelor of Science in Physics at the
University of North Texas, Denton, Texas in August, 1993.

Experience:

First experience...

Second experience...

Professional Memberships:

First membership...

Second membership...