

PHIL012 – SYMBOLIC LOGIC SYLLABUS

Last updated: May 6, 2018

COURSE INFORMATION

Course Name: PHIL012, Symbolic Logic
Section: 004
Course Location: UP. Willard Bldg 167
Course Date & Time: MWF 2:30-3:20PM

INSTRUCTOR INFORMATION

Instructor: David W. Agler
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BRIEF COURSE DESCRIPTION

This is an introductory course in symbolic logic. Logic is the science of correct reasoning. Symbolic logic is a particular branch of logic that studies correct reasoning using a formal or artificial language. This course will articulate two different formal languages: propositional logic and predicate logic. In both languages, we will examine how these artificial languages relate to English (a natural language), different ways in which formal languages can be used to determine whether arguments are valid (or invalid), and how to reason using these languages.

PREREQUISITES

While there are no prerequisites for this course, note that this course satisfies a quantitative requirement (GQ) and so any previous experience you have in mathematics (e.g. algebra or geometry in high school) or knowledge of computer languages will help you greatly. Note, however, that this background is not required.

COURSE OBJECTIVES

There are a number of objectives for this course. By the end of the course you should be able to do (or have done) all of the following:

Objective 1, *Learn Two Symbolic Languages:* Students will learn the vocabulary, syntax, and semantics of two different symbolic languages (propositional & predicate logic) and how these languages relate to English (chs. 1, 2, 6).

Objective 2, *Learn Key Analytical Skills & Vocabulary:* Students will learn how to use the symbolic languages taught in this course to determine certain fundamental features of language and how to talk about these features using analytical vocabulary, e.g. the conditions under which sentences are true or false, the definition of validity (chs.1,3,4,7).

Objective 3, *Learn How to Formally Test Arguments:* Students will learn how to use various mechanical tests (known as “decision procedures”) to (i) test propositions, sets of propositions, and arguments for various properties, e.g. validity and to (ii) develop counter-models for valid arguments (chs.3,4,7).

Objective 3.1, *And, Learn How to Formally Test Real-World Arguments:* Students will learn how to use learned information (ch.2, ch.6) about the relationship between symbolic logic and English with learned information about the truth-tree method (ch.4, ch.7) to mechanically determine whether everyday arguments are deductively valid or invalid.

Objective 4, *Learn How to Solve a Proof:* Students will learn how to formally solve proofs in two different languages. That is, they will learn a set of inference, derivation, or “proof” rules and use these rules to show that a conclusion follows from a set of premises (chs.5,8).

Objective 5, *Learn to Think Like a Logician:* Students will learn how to articulate how certain methods and procedures used in logic relate to various logical properties that belong to everyday argument and arguments in symbolic languages (chs.4,6,7).

Objective 6, *Respectful Dialogue:* Students will engage in respectful conversation with classmates as well as collaborate with their peers to better learn logic.

REQUIRED TEXTS

1. Agler, David W. 2013. *Symbolic Logic: Syntax, Semantics, and Proof*. Lanham, MA: Rowman & Littlefield. *Paperback*: ISBN: 978-1-4422-1742-3. *Hardcover*: ISBN: 978-1-4422-1741-6. **You don't need to bring this book to class.**
2. Agler, David W. 2017. *Symbolic Logic: Syntax, Semantics, and Proof: Handouts*. Available from the Student bookstore on 330 E College Ave, State College, PA 16801. **You DO need to bring this book to class.**^{a, b}

^aIt is highly recommended that you purchase either the paperback or hardcover version of the text. The text contains a variety of mathematical / special symbols that don't display properly on electronic versions of the text.

^bThe text for this course contains an **Errata** (a list of corrections) which can be found here: **chapter A**. Nearly every logic text has these, e.g. **The Logic Book (5th ed)**. It is recommended that you download the Textbook Errata and before each chapter, you use it to correct the text before you begin reading the material. In addition, if you believe there is a typo in the text or in CANVAS, don't hesitate to contact me.

COURSE WORK

ASSESSMENT	NO.	WEIGHT
Homework	5	25%
Exams	5	70%
Quizzes	4	4%
Attend and Part	1	1%

Participation & Attendance: Regular participation is extremely important for academic success. I will take attendance and it will play a role in rounding your grade.

Homework Exercises: On the day each exam is due, you are required to submit an organized set of your homework (e.g. a stapled set of papers). Homework consists of a set of exercises that are found in the CALENDAR portion of this syllabus. Your homework will be graded on the basis of whether it is *complete* and *professionally presented*.

Five Exams: There are **five** exams. The format for each exam varies depending on the material covered.

Quizzes: There are **four** quizzes in this course. Each quiz will be taken online via **CANVAS**. These quizzes will test your conceptual understanding of the material and so it is a good idea to prepare for these quizzes by studying key definitions and concepts.

NOTES ON HOMEWORK

Note 1: Homework is graded out of 10 points.

Note 2: Full credit will be awarded provided you put forward an effort on every problem in the set of exercises. Partial credit will be awarded provided you completed the majority of the exercises.

Note 2: You must turn in a set of **stapled** papers (typed or handwritten). If the papers are not stapled, you will lose 1 point.

Note 3: Your homework must be clearly labeled. For example, if you are assigned homework from Chapter 3, Section 3.5, #1-5, you should label your homework "Chapter 3, Section 3.5, #1-5". If it is not clearly labeled, you will lose 1 point.

Note 4: Homework must be turned in *before* you take the exam. If you turn in homework after the exam, you will lose 1 point for each day it is late (turning the homework in after the exam that same day will stay result in a 1 point deduction).

EMAIL COMMUNICATION

Concerning email correspondence, there are some practices to keep in mind if you want optimal feedback. Be sure to use your PSU email address, address your instructor as the recipient, and include your name as the sender. This ensures your email does not wind up in a junk folder and that your instructor (who may be teaching more than one course) knows what assignment or course you may have referenced. Be sure to include helpful specifics, e.g. the problem number, the page number of the problem, and any solutions you may have tried.

Here is a sample email (for more on best email practices):

Dear (Insert Instructor's Name Here),

I am in your PHIL012 University Park course and am working on problem #A.1 from page 43.

This problem asks how to translate "John is tall and Frank is tall" in the language of PL. I translated this as $F \wedge J$ but the solution on page 45 gives $J \wedge F$ as the answer. Is my answer wrong?

Best wishes, Your Name

DEADLINE & LATE WORK

If you cannot attend an **exam** (and thus turn in your **homework**), it is your responsibility to email me *before* class begins. If you do not, your work will be considered **late** and thus subject to a penalty of a letter grade for each day I do not hear from you.

In rare cases, however, it is impossible to contact me before class begins, e.g. emergencies like hospitalizations. In this case, it will be necessary for you to produce documentation that clearly indicates that (i) you could not attend the exam and (ii) it would have been unreasonable (or impossible) for you to contact me to notify me of your absence. When this is the case, you will be able to make-up the exam and turn in the homework without penalty. *No late work is accepted for quizzes.*

TECHNICAL SUPPORT

For UP Students: contact the ITS Help Desk through their website (<http://itservicedesk.psu.edu>) by phone (814-865-HELP (4357)) or via email (ITShelpdesk@psu.edu).

GRADING SCALE & ROUNDING

This course uses the following grading scale:

A	91–100
A–	90.0–90.9
B+	89.0–89.9
B	81.0–88.9
B–	80–80.9
C+	79.0–79.9
C	70.0–78.9
D	60.0–69.9
F	0–59.9

Grades will be rounded up from the second decimal point, e.g. 90.95 rounds up to 91.0 while 90.94 rounds down to 90.90. In the event that eLION does not allow for a particular grade (e.g. D+), you will simply be given the letter grade (e.g. if you have a D+ then you will receive a D, and if you have a C–, you will receive a C).

CALCULATING YOUR GRADE

While CANVAS provides a rough approximation of your grade, the syllabus is the definitive guide for determining your grade. See also, University Grading Scale and University Policy 47-00.

CURVING

The policy on curving or dropping assignments is at the discretion of the instructor. The default policy is that individual assignments will not be curved. However, in the case that the average grade for students who have fully completed the course is below 75%, a curve will be instated so that the average grade of students who completed the course is 75%.

ON DROPPING THE COURSE

Consult the Registrar or your academic adviser for drop procedures. Consult the Handbook for taking an Incomplete (D/F).

DISABILITY STATEMENT

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. Student Disability Resources (SDR) Web site provides contact information for every Penn State campus: <http://equity.psu.edu/sdr/disability-coordinator>. For further information, please visit Student Disability Resources Web site: <http://equity.psu.edu/sdr>.

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <http://equity.psu.edu/sdr/guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

ACADEMIC MISCONDUCT

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

COUNSELING AND PSYCHOLOGICAL SERVICES

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

- Counseling and Psychological Services at University Park (CAPS) (<http://studentaffairs.psu.edu/counseling/>): 814-863-0395
- Counseling and Psychological Services at Commonwealth Campuses (<http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/>)
- Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
- Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

EDUCATIONAL EQUITY & REPORT BIAS STATEMENTS

Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined on the University's Report Bias webpage (<http://equity.psu.edu/reportbias/>)

STATEMENT ON DIVERSITY, EQUITY, AND INCLUSION

The Pennsylvania State University is committed to and accountable for advancing diversity, equity, and inclusion in all of its forms. We embrace individual uniqueness, foster a culture of inclusive excellence that supports both broad and specific diversity initiatives, leverage the educational and institutional benefits of diversity, and engage all individuals to help them thrive. We value inclusive excellence as a core strength and an essential element of our public service mission. At Penn State:

- We will foster and maintain a safe environment of respect and inclusion for faculty, staff, students, and members of the communities we serve.
- We will educate our faculty, staff, and students to be social justice advocates, creatively providing curricula, programs, and environments that reflect the diversity of our communities, and elevate cultural awareness.
- We will ensure fair and inclusive access to our facilities, programs, resources, and services, and ensure that all of our policies and practices are inclusive and equitable.
- We will advance and build our workforce by assessing hiring practices and performance review procedures to attract, retain, and develop talented faculty and staff from diverse backgrounds.
- We will address intergroup disparities in areas such as representation, retention, learning outcomes, and graduation rates.

Lesson 1	Introduction to Logic
<i>Reading</i>	Chapter 1
<i>Exercises</i>	Ex Set #1, pp.12-13: A. 1-5, B. 1-5, End-of-Chapter Exercises, p.20-22: A.1-5, B.1-5, C.1-5
<i>Assessments</i>	Jan 22 Quiz 1
Lesson 2	Chapter 2
<i>Reading</i>	Chapter 2
<i>Exercises</i>	Ex Set #1, pp.43-45: A. 1-5, B. 1-5, C. 1-5, D. 1-5. End-of-Chapter Exercises, pp.58-60: A. 1-5, B. 1-5, C. 1-5, D. 1-7, E. 1-5, F. 1-5, G. 1-3
<i>Assessments</i>	Jan 26 Homework #1, Exam #1
Lesson 3	Truth Tables
<i>Reading</i>	Chapter 3
<i>Exercises</i>	Ex Set #1, pp.68: A.1-7, Ex Set #2, pp.74: A.1-5, Ex Set #3, pp.80: A.1-5, End-of-Chapter Exercises, pp.92-94: A.1-3, B.1-3, C.1-3, D.1-3
<i>Assessments</i>	Feb 2 Quiz 2
Lesson 4	Truth Trees
<i>Reading</i>	Chapter 4
<i>Exercises</i>	Ex Set #2, pp.118-119: A. 1-7, Ex Set #3, pp.125: A. 1-7, Ex Set #4, pp.132: A. 1-5, Ex Set #5, pp.141-142: A. 1-3, End-of-Chapter Exercises, pp.150-151: A.1-3, B.1-3, C.1-3, D.1-5
<i>Assessments</i>	Feb 9 , Homework #2, Exam #2
Lesson 5	Derivations
<i>Reading</i>	Chapter 5
<i>Exercises</i>	Ex Set #1, pp.168: A.1-5; Ex Set #2, pp.180: A. 1-5, 9; Ex Set #3, pp.182: A.1-5; Ex Set #4, pp.189-190: A.1-7, B. 1-3; Ex Set #5, pp.198: A.1-3; Ex Set #6, pp.206-7: A. 1-5, B. 1-5; End-of-Chapter Exercises, pp.223-241: Easy 1-5, Medium 34-39, Hard 67-73, Zero-Premise 102-111; Conceptual and Application Exercises 1-2
<i>Assessments</i>	Mar 2 Quiz 3
<i>Assessments</i>	Mar 16 , Homework #3, Exam #3
SPRING BREAK	Mar 4 - 10
Lesson 6	Predicate Syntax & Semantics
<i>Reading</i>	Chapter 6
<i>Exercises</i>	Ex Set #1, pp.255: A. 1-7; Ex Set #2, pp.261-262: A. 1-5, B. 1-5, C. 1-5; Ex Set #3, pp.269: A. 1-5, B. 1-5; Ex Set #4, pp.276: A.1-5; Ex Set #5, pp.280-281: A. 1-5, B. 1-5
<i>Assessments</i>	Mar 28 Quiz 4
Lesson 7	Predicate Logic Trees
<i>Reading</i>	Chapter 7
<i>Exercises</i>	Ex Set #1, pp.292: A. 1-5; Ex Set #2, pp.302: A. 1-5; Ex Set #3, pp.307-308: A.1-3; Ex Set #4, pp.311: A.1-3; Ex Set #5, pp.316: A.1-5
<i>Assessments</i>	April 9 , Homework #4, Exam #4
Lesson 8	Predicate Logic Derivations
<i>Reading</i>	Chapter 8
<i>Exercises</i>	Ex Set #1, pp.333: A. 1-5; Ex Set #2, pp.346: A. 1-7; End-of-Chapter Exercises, pp.352: A. 1-7, B. 1-7

Lesson 9	Predicate Logic: Identity, Descriptions, Functions
<i>Reading</i>	TBA
<i>Exercises</i>	TBA
<i>Assessments</i>	April 27 and TBA , Homework #5, Exam #5

A

Textbook Errata

Errata for *Symbolic Logic: Syntax, Semantics and Proof* (2013) by David W. Agler

Last Updated: 8/19/2014

New version of this errata can be found here:

http://davidagler.com/teaching/logic/textbook/ErrataForSymbolic%20Logic_SP2013.pdf

Below is a list of the typographical errors in *Symbolic Logic: Syntax, Semantics and Proof*. The publisher ran a 2nd printing of the book sometime after 5/27/13 that includes all of the non-grey corrections.

Corrections marked in grey were found post 5/27/13 (i.e. after the second printing).

Corrections marked in turquoise are found *only* in the 2nd printing.

*Thanks go out to the many great students in my PHIL012 (Symbolic Logic) courses for catching these typographical errors. They include: Christopher Allaman, Charles Banks, Ashley Brooks, Angel Bingham, Delores Casey, Alli Charney, Chris Connard, Aurora Cooper, Maureen Dunn, Elliannies Duran, Ariel Endresen, Nayib Felix, Joy Garcia, Robin Hager, Rachel Heilman, Catherine Hendricks, Michael Humphries, Lyric Joseph-Armstrong, Alex Kirk, Tira Koebler, Edward Lackner, Ivan Maldonado, Helena Murphy, Anne-Marie Pietersma, Jennifer Pronko, Cynthia Roebuck, Brooke Santkiewicz, Ariel Valdez, and Kathy Weden.

Chapter 1

p.9, above 2nd table. Change "In everyday speech, the parts of an **arguments**" to "In everyday speech, the parts of an argument"

p.22, C. Conceptual Questions. #5. Delete the asterisk (*) on "5".

Chapter 2

p.31, toward top of page (definition of Conjunction= df.). Rewrite for clarity: "If the truth values of both of the conjuncts are true, then the complex proposition (the conjunction) is true."

p.33, "One way of translating (4_E) is by a single letter, since (4_E) is a proposition" replace with "One way of translating (5_E) is by a single letter, since (5_E) is a proposition"

p.34, last paragraph, replace (1)s with (2)s and replace (2)s with (3)s.

p.40, line 1, remove "do" in "In order to do achieve"

p.42, middle of page in block quote, line 3. Change " $R \vee \neg M$ is" to " $R \vee \neg M$ is"

p.44, Exercise Set C, #6, change " $\neg J \rightarrow \neg (R \vee R)$ " to " $\neg J \rightarrow \neg (R \wedge R)$ "

p.45, last line: replace " \wedge " with " \vee "

p.46, line 4 after **PvQ**. Change "the proposition to the right of the caret" to "the proposition to the right of the wedge"

p.54, 5th line from the top, replace "Toronto is not the largest city in Ontario" with "Toronto is not the largest city in Canada"

p.57, 6th line up from the bottom "Liz will be ... she is an automobile accident" should be "... she is in an automobile accident"

p.57, 4th line up from the bottom "'P unless Q' as '**PvQ**'" should read "'P unless Q' as ' $\neg P \vee Q$ '"

p.58, in row that reads "not P unless Q", to the immediate right, it should read " $\neg P \vee Q$ "

p.58, in row that reads "P unless Q", formula to the right should read " $(P \vee Q) \wedge \neg (P \wedge Q)$ or $\neg (P \leftrightarrow Q)$ "

p.59, D. Basic Translation, #2: should read "... Mary is a happy woman" not "happy women"

p.62, in table at bottom, in row involving "not P unless Q", change "**PvQ**" to " $\neg P \vee Q$ "

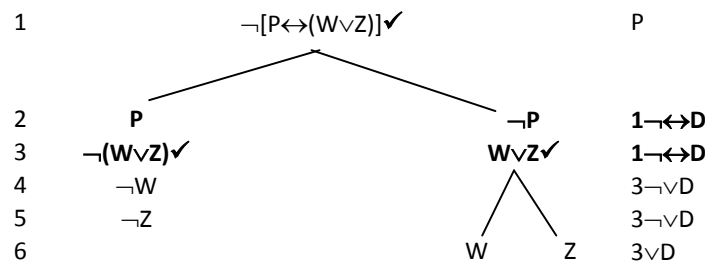
Errata for Symbolic Logic

Chapter 3

- p.67, 2nd full paragraph under $Z \wedge \neg J$, replace two instances of "B" with "J"
- p.68, Exercise Set #1, Section A, #7, delete $v(C)=T$.
- p.85, in table at the top, in the 3rd column / 5th row (under $P \rightarrow Q$), change from "F" to "T".
- p.93, End-of-Chapter Exercises, D, #4, change " $P \rightarrow M, \neg P \vdash \neg M$ " to " $P \rightarrow M, \neg M \vdash \neg P$ "
- p. 97, definition of invalidity: change "valid" to "invalid"
- p.99, 1st paragraph, 2nd to last line, first word, replace "economical" with "economically"

Chapter 4

- p.108, 2nd to last sentence, replace "Consider (2)" with "Consider (3)"
- p.116, last paragraph, replace ' $C \vee D$ ' with ' $C \wedge D$ '.
- p.120, bottom of page, replace all " \vee "s with " \rightarrow " sign.
- p.119, Solutions to Starred Exercises in Exercise Set #2, Problem #5, remove check mark from $P \wedge (P \vee Z)$ at line 1
- p.122, 1st line in 4.3.3. Negated Conjunction Decomposition: replace ": when both of the conjuncts are false" with ": when both of the conjuncts are true"
- p.122, bottom of page, replace " $P \rightarrow (W \wedge Z)$ " with " $P \leftrightarrow (W \wedge Z)$ "
- p.124, 2nd tree, right branch, line 3 should be " $W \vee Z$ ". From here, line 3 should be decomposed with "W" on one branch and "Z" on the other branch. Decomposition rule should be " $3 \vee D$ " rather than " $3 \wedge D$ ". Delete line 7. The tree is reproduced here:



- p.124, bottom of page, paragraph before final example; replace " $\neg[\neg P \vee \neg Z]$ " with " $\neg(\neg P \vee \neg Z)$ "
- p.125, #7, remove sign for negation in " $\neg R \rightarrow (R \vee L)$ "; should be " $R \rightarrow (R \vee L)$ "
- p.126 #3, right branch, line 3 should be " $\neg M$ " rather than "M"
- p.133 #3, line #1, remove checkmark after " $A \vee B$ "
- p.139, last line on page: should read "Thus, the right branch is closed." rather than "Thus, we consider the left branch closed."

Chapter 5

- p.162, last full sentence on page; delete "a" in "for a the derivation rule."
- p.164, first sentence in last full paragraph; rewrite as "If conjunction introduction were formulated only by using propositional letters instead of metalinguistic variables, then it would only be an acceptable rule for deriving premises 'P' and 'Q.'"
- p.165, below example that involves "John is angry", 2nd sentence, replace "to derive a second proposition" with "to derive a third proposition"
- p.166, top of page, line 4, column 3, replace " $3 \rightarrow D$ " with " $3 \neg \wedge D$ "
- p.169, problem #7, line 2, replace " $(P \rightarrow Q) \wedge T$ " with " $(P \rightarrow Q) \wedge Y$ "
- p.169, example at bottom of page, line 4 ½, add line number in first column 5. Change line 5 to line 6.
- p.174, first example, line #1, third column, change " P/Q " to " $P / P \rightarrow Q$ "

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p.175, example #2 and #3 from the top (3rd column), replace " $A/A \rightarrow D$ " in both with " $A/S \rightarrow D$ "

p.176, bottom of page in box "Conditional Elimination", fourth column, move " $\rightarrow E$ " so that it is adjacent with (to the immediate right of " Q ")

p.179, first table on page should look as follows:

1	P		P
2		S	A
3		P \wedge S	1,2 \wedge I

p.179, second table on page, line 3, replace " $P \wedge W$ " with " $P \wedge S$ "

p.180, #1, line 1, third column, should be " P / C " rather than " $P / B \rightarrow C$ "

p.182, top example, line #3, column #3, replace " $A/\neg I$ " with " $P, \neg P$ "

p.183, 2nd example, line #3, column #3, replace " $A/\neg E$ " with " $P, \neg P$ "

p.186, first example, line 4, third column; replace " $2,4 \rightarrow E$ " with " $2,3 \rightarrow E$ "

p.188, table for Biconditional Elimination", rule has " P " and " Q " directly under " $P \leftrightarrow Q$ ", these should be left aligned.

p.188, second to last example: line #1; replace " $(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow T)$ " with " $(P \leftrightarrow Q) \leftrightarrow (R \rightarrow T)$ "

p.189, last example on page; replace " $P \leftrightarrow Q, Q, P \vdash (P \vee \neg Z) \leftrightarrow (\neg Z \vee P)$ " with " $P \leftrightarrow Q, Q \vdash (P \vee \neg Z) \leftrightarrow (\neg Z \vee P)$ "

p.189, line #8, third column, replace " $4-5,5-6 \leftrightarrow I$ " with " $4-5,6-7 \leftrightarrow I$ "

p.191, problem #9, line #5, third column, replace " $2,4 \rightarrow D$ " with " $2,4 \rightarrow E$ "

p.192, continuation of #9, line #7, third column, replace " $6,3 \rightarrow D$ " with " $3,6 \rightarrow E$ "

p.198, Solution to Ex. #1, line 2, column #3, replace " $P/\neg P$ " with " P "

p.201, third full paragraph, replace "Since ' $\neg(P \wedge P)$ ' is the goal" with "Since ' $\neg(P \wedge \neg P)$ ' is the goal"

p.202, middle of page, replace " $(P \vee R) \rightarrow P$ " in " $R \vdash (P \vee R) \rightarrow P$ " and at line #1 with " $(P \vee R) \rightarrow R$ "

p.205, top of page, replace " $\neg(\neg P \neg \wedge \neg Q)$ " with " $\neg(\neg P \wedge \neg Q)$ "

p.206, Exercise Set #6, problem #4, replace " $\vdash P \vee \neg P$ " with " $\vdash \neg \neg(P \vee \neg P)$ "

p.214, middle of page, line #2, 3rd column, replace " $2DeM$ " with " $1DeM$ "

p.219, 3rd example on page, replace line #6 " $\neg R$ " with " $\neg R \wedge \neg M$ ", and replace line #7 (3rd column) " $5DeM$ " with " $6\wedge E$ "

p.219, under 5.6.1, 1st paragraph, 2nd sentence: replace "In many case" with "In many cases"

p.225, #13, line #4, 3rd column; replace " $1,3DS$ " with " $1,2DS$ "

p.227, #42, replace " $(B \rightarrow C) \rightarrow \neg(D \rightarrow E), C \vdash \neg E$ " with " $(\neg B \vee C) \rightarrow \neg(D \rightarrow E), C \vdash \neg E$ "

p.228, #39, remove line 4 and renumber line 5 as "4"

p.228, #42, replace " $(B \rightarrow C) \rightarrow \neg(D \rightarrow E), C \vdash \neg E$ " with " $(\neg B \vee C) \rightarrow \neg(D \rightarrow E), C \vdash \neg E$ " AND replace line #1 with " $(\neg B \vee C) \rightarrow \neg(D \rightarrow E)$ "

p.228, #41, line 4, 3rd column, replace " $1 \rightarrow E$ " with " $1,3 \rightarrow E$ "

p.230, #55 replace problem with the following:

$$F \vee [(G \wedge D) \wedge M] \vdash (F \vee M) \vee R$$

1	F \vee [(G \wedge D) \wedge M]	P / (F \vee M) \vee R
2	\neg [(F \vee M) \vee R]	A / contra
3	\neg (F \vee M) \wedge \neg R	2DeM
4	\neg (F \vee M)	3 \wedge E
5	\neg F \wedge \neg M	4DeM
6	\neg F	5 \wedge E

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7	$\neg M$	$5 \wedge E$
8	$(G \wedge D) \wedge M$	1,6DS
9	M	$8 \wedge E$
10	$\neg M$	7R
11	$(F \vee M) \vee R$	2-10 $\neg E$

p.230, #53, line #12, third column: replace "2,9" with "9,11DS"

p.233, #73, line #9, right column: replace " $7 \vee E$ " with " $7 \wedge E$ "

p.233, #73, line #7, third column, to DEM, add "+DNx2"

p.234, #79, line 6, third column should be 2-5 $\neg E$

p.234, #79, line 11, third column, change " $7-10 \rightarrow I$ " to " $7-10 \neg I$ "

p.235, first proof on page, #2, 3rd column, replace " $1 \wedge E$ " with " $1 DN$ "

p.236, #88, line 4, 3rd column, replace " $1 \rightarrow E$ " with " $1,3 \rightarrow E$ "

Chapter 6

p.249, 1st line; delete "such a language"

p.249, first sentence in second full paragraph: replace "In additional to names" with "In addition to names"

p.252, in last full paragraph on page, last sentence, change "'a instance of a variable.'" to "an instance of a variable."

p.261, 2nd line from top, labeled #5, should be "If ' $\neg Qa$ ' and ' $(\forall x)Rx$ ' are wffs" rather than "'If ' $\neg Qa$ ' and ' $(\forall x)Px$ ' are wffs"

p.261, second example, line 5: should be: ' $(\exists y) Gy$ ' is a wff rather than ' $(\exists x) Gy$ ' is a wff & replace "Lines 1,5" with "Lines 1,4"

p.261, second example, line 6 ' $(\exists y) Gy$ ' are wffs rather than ' $(\exists x) Gy$ ' are wffs

p.252, last full paragraph on page, last sentence, change "'a instance of a variable.'" to "an instance of a variable."

p.257, Section 6.3.2, 2nd paragraph, 2nd sentence, replace "we learn to how to" with "we learn how to"

p.262, Exercise Set #2, C, #2, replace " $Raa \rightarrow Pa$ " with " $Ra \rightarrow Paa$ "

p.262, Exercise Set #2, #4, replace " $(\exists x)Px$ " with " $(\exists x)Pxx$ "

p.262, Solution Set B, #5, add sentence "the variable 'x' is in the scope of $(\exists w)$ "

p.263, Solution Set C, #1, replace: "name (rule i). 'Paa' is a one-place predicate" with "name (rule i). 'Paa' is a two-place predicate"

p.263, Section 6.4.1, 1st paragraph, 3rd line up from the bottom, replace "of integers" with "integers"

p.267, last paragraph, 5th line down, replace "the name designate" with "the name designates"

p.267, 4th line up from the bottom, replace "simpler values of" with "simpler"

p.268, 4th line up from the bottom, replace "8" with "8"

p.268-269, need to bold several letters throughout these pages. Here they are:

- p.268, 2nd to last paragraph (1st line): for any name '**a**,"
- p.268, 2nd to last paragraph (1st line): "**a**-variant or **a**-varies"
- p.268, 2nd to last paragraph (2nd line): "interprets '**a**' "
- p.268, 2nd to last paragraph (3rd line): "assigns to '**a**' (i.e.,"
- p.268, 2nd to last paragraph (4th line): "all **a**-variant"
- p.268, 2nd to last paragraph (5th line): "all assign '**a**' to an object"
- p.268, 2nd to last paragraph (6th line): "they assign to '**a**.'" "
- p.268, 2nd to last paragraph (table at bottom of page): all **a**'s in single quotation marks should be bolded

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- p.269, first full paragraph: all a's in single quotations marks should be bolded

p.269, Exercise Set #3, B, #2: replace " $(\forall x)Lxy$ " with " $(\forall x)(\forall y)Lxy$ "

p.270, B., #1: should be $v(\forall x)Lxx=F$ rather than $v(\forall x)Lxx=T$

p.270 B., #3: should be $v(\exists x)\neg Lxx=T$ rather than $v(\exists x)\neg Lxx=F$

p.270, last line on page: delete second (3).

p.272, middle of the page (3B*), replace "it will be also be happy" with "it will also be happy"

p.272, 3rd sentence from the bottom reads "Notice that in the case of (5), which is " $(\forall x)(Zx \rightarrow Hx)$ ", the formula should read " $\neg(\forall x)(Zx \rightarrow Hx)$," "

p.276, in table, 2nd line, change "is moveable" to "is movable"

p.277, #7, should be "and everyone hates him or herself" rather than "and everyone hates everyone"

p.279, table that reads "English Sentence", rows #2, #3, #5 replace outermost parentheses with brackets

p.279, table that reads "English Sentence", row #6, formula should read $(\forall x)(\exists y)[(Hx \wedge Zy \rightarrow \neg Lxy)]$

p. 280, 2nd set of formulas on page, under $(\exists x)(\forall y)Lxy$, there is $(\forall y)(\exists x)Lxy$. This should read: " $(\forall x)(\exists y)Lxy$ "

p. 280, sentence in the last paragraph that reads "' $(\forall y)(\exists y)Lxy$ ' expresses the proposition" should read "' $(\forall x)(\exists y)Lxy$ ' expresses the proposition"

p. 280, prompts for Exercise A and B read "translate the predicate logic expressions below into English" when they should read "translate the following English sentences into the language of predicate logic"

p. 280, Exercise Set #5, set B, after "Lxy: x loves y", add "s: Sally"

Chapter 7

p.288, second example on page, line 6, column #3, replace " $2 \rightarrow D$ " with " $5 \rightarrow D$ "

p.289, bottom example on page, replace " $(\exists x)(Py \rightarrow Ry)$ " with " $(\exists y)(Py \rightarrow Ry)$ " in the formula above the example and in line #1

p.290 (correction from previous page), line #1, replace " $(\exists x)(Py \rightarrow Ry)$ " with " $(\exists y)(Py \rightarrow Ry)$ "

p.292, first example on page, line 4, column #3, replace " $1 \forall D$ " with " $3 \forall D$ "

p.292, Exercise Set #1, Exercise #3, replace " $(\exists x)(Px \wedge \neg Qx)$, $(\forall x)Px \rightarrow (\forall x)Qx$ " with " $(\exists x)(Px \wedge Qx)$, $(\forall x)Px \rightarrow (\forall x)Qx$ " (this influences the answer on p.293 (see below))

p.293, exercise #3, replace " $(\exists x)(Px \wedge \neg Qx)$, $(\forall x)Px \rightarrow (\forall x)Qx$ " with " $(\exists x)(Px \wedge Qx)$, $(\forall x)Px \rightarrow (\forall x)Qx$ ", line #1: replace " $(\exists x)(Px \wedge \neg Qx)$ " with " $(\exists x)(Px \wedge Qx)$ ", line #3 replace " $Pa \wedge \neg Qa$ " with " $Pa \wedge Qa$ ", and line #5, replace " $\neg Qa$ " with " Qa ".

p.293, exercise #3, 1st line in the description below the tree. Replace "forms of a" with "forms a"

p.295, first example: there are two #8's on the page, replace second "8" with "9"

p.298, middle example, line 3, 3rd column, replace " $1 \exists D$ " with " $2 \exists D$ "

p.299, first example on page, line 9, column #3, replace " $4 \rightarrow D$ " with " $5 \rightarrow D$ "

p.301, line 10 contains a mistake that impacts the rest of the tree; recreated here is the rest of the tree to fix the mistake in line 10:

1	$\neg(\forall x)(\exists y)(Pxy) \wedge (\forall y)\neg(\exists x)(Rxy)$ ✓	P
2	$\neg(\forall y)(\forall x)(Rxy)$ ✓	P
3	$(Rab \wedge Rba) \wedge Pab$ ✓	P
4	$Rab \wedge Rba$ ✓	$3 \wedge D$
5	Pab	$3 \wedge D$
6	Rab	$4 \wedge D$
7	Rba	$4 \wedge D$
8	$\neg(\forall x)(\exists y)(Pxy)$ ✓	$1 \wedge D$
9	$(\forall y)\neg(\exists x)(Rxy)$	$1 \wedge D$

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10	$(\exists x)\neg(\exists y)(Pxy)$ ✓	8¬∇D
11	$(\exists y)\neg(\forall x)(Rxy)$ ✓	2¬∇D
12	$\neg(\exists y)(Pcy)$ ✓	10∃D
13	$(\forall y)\neg(Pcy)$	12¬∃D
14	$\neg Pca$	13∇D
15	$\neg Pcb$	13∇D
16	$\neg Pcc$	13∇D
17	$\neg(\forall x)(Rxe)$ ✓	11 ∃D
18	$(\exists x)\neg(Rxe)$ ✓	17 ¬∇D
19	$\neg Rfe$	18 ∃D
20	$\neg(\exists x)(Rxa)$ ✓	9∇D
21	$\neg(\exists x)(Rxb)$ ✓	9 ∇D
22	$\neg(\exists x)(Rxe)$ ✓	9 ∇D
23	$\neg(\exists x)(Rxf)$ ✓	9 ∇D
24	$(\forall x)\neg(Rxa)$	20 ¬∃D
25	$(\forall x)\neg(Rxb)$	21 ¬∃D
26	$(\forall x)\neg(Rxe)$	22 ¬∃D
27	$(\forall x)\neg(Rxf)$	23 ¬∃D
28	$\neg Rab$	25 ∇D
	X	

from here, on p.302, the second to last line should read "Rather than starting by decomposing line 24 with multiple uses of (∇D), you can decompose line 25 into line 30 using one instance of (∇D) involving 'P(b/x).'"

p.302, Exercise Set #8, replace "(x)(Px→Qx)" with "(∇x)(Px→Qx)"

p.303, #5, center column, place check marks (✓) to the formulae on line #3 and #7

p.304, #11, lines 6-7, change justification (3rd column) from "2∧D" to "4∧D"

p.305-306, last example on page that extends to p.306, there is mistake in the justification of line #6 that causes a problem in line #7; replace line #6 with "¬(Qa∨¬Rb)". As this changes how the rest of the problem is solved, the answer is reproduced below:

1	$(\exists x)\neg(\forall y)[Px\rightarrow(Qx\vee\neg Ry)]$ ✓	P
2	$\neg(\forall y)[Pa\rightarrow(Qa\vee\neg Ry)]$ ✓	1∃D
3	$(\exists y)\neg[Pa\rightarrow(Qa\vee\neg Ry)]$ ✓	2¬∇D
4	$\neg[Pa\rightarrow(Qa\vee\neg Rb)]$ ✓	3∃D
5	Pa	4¬→D
6	$\neg(Qa\vee\neg Rb)$ ✓	4¬→D
7	$\neg Qa$	6¬∇D
8	$\neg\neg Rb$	6¬∇D

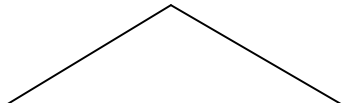
p.308, #6, change "(∃x)[(Fx∧Px)∨(∇y)(Py→Fy)]" to "(∃x)(Fx∧Px)∨(∇y)(Py→Fy)"

p.308, #9, change "(∇x)(Pxx→Paa)" to "(∇x)Pxx→Paa"

p.308, solution to #1, line #4, column #3, replace "1¬→D" with "3¬→D"

p.310, first example in "Section 7.3.4 Logical Equivalence", line #6, column #4, missing a justification: write in "2∇D"

p.311, line 11, replace "(∃x)(Px∨Gx)" with "(∃x)¬¬(Px∨Gx)", as this influences the rest of the problem, the entire solution is produced below:

1	$\neg\{[(\forall x)\neg(Px\vee Gx)] \leftrightarrow [(\forall y)(\neg Py \wedge \neg Gy)]\}$ ✓	P
		
	6	

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2	$(\forall x)\neg(Px \vee Gx)$	$\neg(\forall x)\neg(Px \vee Gx) \checkmark$	1 $\neg \leftrightarrow D$
3	$\neg(\forall y)(\neg Px \wedge \neg Gx) \checkmark$	$(\forall y)(\neg Px \wedge \neg Gx)$	1 $\neg \leftrightarrow D$
4	$(\exists y)\neg(\neg Px \wedge \neg Gx) \checkmark$		3 $\neg \forall D$
5	$\neg(\neg Pa \wedge \neg Ga) \checkmark$		4 $\exists D$
	\swarrow		
6	$\neg\neg Pa \checkmark$		5 $\neg \wedge D$
7	Pa		6 $\neg \neg D$
8	$\neg(Pa \vee Ga) \checkmark$		2 $\forall D$
9	$\neg Pa$		8 $\neg \vee D$
10	X		8 $\neg \vee D$
11			2 $\neg \forall D$
12		$(\exists x)\neg\neg(Px \vee Gx) \checkmark$	2 $\neg \forall D$
13		$\neg\neg(Pa \vee Ga)$	11 $\exists D$
		$Pa \vee Ga \checkmark$	12 $\neg \neg D$
	\swarrow	\searrow	
14	Pa	Ga	13 $\vee D$
15	$\neg Pa \wedge \neg Ga \checkmark$	$\neg Pa \wedge \neg Ga \checkmark$	3 $\forall D$
16	$\neg Pa$	$\neg Ga$	15 $\wedge D$
	X	X	

p.311–312, Exercise Set #4, #1, change problem from “ $(\forall x)\neg Px, \neg(\exists x)Px$ ” to “ $(\forall x)Px, \neg(\exists x)Px$ ”. This has an effect on the solution:

1. * $(\forall x)Px, \neg(\exists x)Px$; not equivalent

1	$\neg[(\forall x)Px \leftrightarrow \neg(\exists x)Px] \checkmark$	P	
	\swarrow		
2	$(\forall x)Px$	$\neg(\forall x)Px \checkmark$	1 $\neg \leftrightarrow D$
3	$\neg\neg(\exists x)Px$	$\neg(\exists x)Px \checkmark$	1 $\neg \leftrightarrow D$
4		$(\exists x)\neg Px \checkmark$	2 $\neg \forall D$
5		$(\forall x)\neg Px$	3 $\neg \exists D$
6		$\neg Pa$	4 $\exists D$
7		$\neg Pa$	5 $\forall D$
		0	

p.313, first tree on page, line #10, justification (3rd column) should be “3 $\neg \exists D$ ”.

p.314, paragraph under definition of “Invalidity”, replace “simple argument: ‘ $(\forall x)Pa \vdash Pa$.’” with “simple argument: ‘ $(\forall x)Px, Pa \vdash Pa$.’”

p.314, in first two examples on page, replace “ $(\forall x)Pa$ ” with “ $(\forall x)Px$ ”

p.315, example at the bottom, line #7, replace “1 $\forall D$ ” with “2 $\forall D$ ”

p.318, 6 lines up from the bottom of the page, delete “for any substitution instance”

p.320, Solutions to Starred Exercises, #1, replace “ $(\forall x)Px \rightarrow Qx$ ” with “ $\neg(\forall x)(Px \rightarrow Qx)$ ”

p.321, exercise #5, line #12, far-right column, replace “5 $\rightarrow D$ ” with “7 $\rightarrow D$ ”

p.321, exercise #1 (top of page), add “10” below “9” in left-hand column.

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p.322, B, #1, 2nd tree on page, line #9, 3rd column, replace " $6 \neg \neg D$ " with " $7 \neg \neg D$ "

p.322, D. exercise #3, line #6, replace " $4 \exists D$ " with " $2 \exists D$ "

Chapter 8

p.328, after first proof, line 3, replace "an individual already" with "an individual constant already"

p.329, example at top of page, line #9, third column, replace " $8,9 \wedge$ " with " $7,8 \wedge$ "

p.329, 2nd sentence after heading "8.1.2 Existential Introduction (\exists)", replace "The procedure involves introducing an existential quantified" with "The procedure involves introducing an existentially quantified"

p.332, line #4, third column, replace " $2 \wedge E$ " with " $3 \wedge E$ "

p.332, line #5s, replace 2nd line #5 with "6"

p.332, 2nd line #5 (new line #6), third column, replace " $4 \exists$ " with " $5 \exists$ "

p.333, #11, change " $(\exists y)(Wyc)$ " in " $Wab \wedge Qbc \vdash [(\exists y)(Way \wedge Qyc) \wedge (\exists y)(Wyb)] \wedge (\exists y)(Wyc)$ " to " $(\exists y)(Qyc)$ "

p.334, #9, first line in problem prompt, add second premise "Paa"

p.334, #11, change " $(\exists y)(Wyc)$ " in " $Wab \wedge Qbc \vdash [(\exists y)(Way \wedge Qyc) \wedge (\exists y)(Wyb)] \wedge (\exists y)(Wyc)$ " to " $(\exists y)(Qyc)$ "

p.334, #11, line #6, change " $(\exists y)Wyc$ " to " $(\exists y)Qyc$ "

p.334, #11, line #8, change " $(\exists y)(Wyc)$ " in " $Wab \wedge Qbc \vdash [(\exists y)(Way \wedge Qyc) \wedge (\exists y)(Wyb)] \wedge (\exists y)(Wyc)$ " to " $(\exists y)(Qyc)$ "

p.334, #11 in the description below the proof, 2nd line replace " $Pab \wedge Qbc$ " with " $Wab \wedge Qbc$ "

p.336, 1st paragraph, last line in paragraph, place single quotation marks around 'R' in "and R, while"

p.339, 3rd example, line " $k+2$ ", add missing close parenthesis to formula: " $(\forall x)\{[(\exists x)Qx] \wedge (Ex \wedge Gx)\} \rightarrow \neg Px$ "

p.341, 1st full paragraph after 1st proof, replace "is valid is" with "is valid"

p. 345, 1st paragraph, 3rd line: replace " ' $(\exists x)Px$ ' says some number is prime" to " ' $(\exists x)Ex$ ' says that some number is even"

p.345, 2nd proof, line 2, justification column, replace " $1 \forall I$ " with " $1 \forall E$ "

p.346, 1st paragraph, last line, replace "validly infer ' $(\exists x)(Wzz)$ '" with "derive ' $(\exists z)Wzz$ '"

p.346, 1st example, line 4, 3rd column, replace $4 \exists$ with $3 \exists$

p.346, last example before Exercise Set #2, line #4, replace " $(\exists x)Py$ " with " $(\exists y)Py$ "

p.349, first example, line #6: " $\neg(\forall x)\neg(Wzz \rightarrow \neg Mz)$ " to " $\neg(\forall z)\neg(Wzz \rightarrow \neg Mz)$ "

p.349, 4th paragraph, line 1: replace "quantified antecedent" with "quantified consequent"

p.349, last example, line #7: justification column, change " $6 I$ " to " $6 \forall I$ "

p.350, last paragraph, 2nd line, replace "it is simply an complex" with "it is simply a complex"

p.350, last proof on page, line 2, 3rd column: replace $(\exists x)Sb$ with $(\exists x)Sx$

p.351, last example, change justification of line #8 from " $3 \rightarrow E$ " to " $3, 7 \rightarrow E$ "

p.351, last example, change justification of line #10 from " $4, 9 \neg \rightarrow E + DN$ " to " $4, 9 MT + DN$ "

p.352, exercise #19, change " $(\exists x)[Px \wedge (\forall y)(Py \rightarrow Ryx)] \vdash (\exists x)(Px \wedge Rxx)$ " to " $(\exists x)[Px \wedge (\forall y)(Py \rightarrow Ryxb)] \vdash (\exists x)(Px \wedge Rxxb)$ "

p.353, exercise #3, line #4 and #5, replace " $(\exists x)Gx$ " with " $(\exists z)Gz$ "

p.354, exercise #11, line #6, replace " $(\forall x)Fx$ " with " $(\forall x)Px$ "

p.354, exercise #13, line #9, change " $(\forall x)(Px \rightarrow Mx)$ " to " $(\forall x)(Fx \rightarrow Mx)$ "

p.354, exercise #15, line 6, change " $1, 5 \neg \vee E$ " to " $1, 5 DS$ "

p.354, exercise #15, line 9, change " $7, 8 \neg \vee E$ " to " $7, 8 MT$ "

p.355, exercise #17, line 11, change " $9, 10 \neg \rightarrow E$ " to " $9, 10 MT$ "

Appendix

p.359, 2nd and 3rd row of table (3rd column), switch "Negation (\neg)" and "Conjunction (\wedge)"

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Kindle Version (Possible Typos)

Ch.2, Section 2.4.1, above table that contains (4E*): delete "3" in " $(M \vee 3K) \wedge \neg (M \wedge K)$ "

Ch.2, In End of Chapter Exercises, Exercise D. #6 "fiee" in "If John is hungry or a zombie, then Mary should fiee" should be replaced with "flee"

Ch.3. Exercise Set #2, #3 ?