

**TYPOS AND ERRORS IN
LOGIC FOR COMPUTER SCIENCE**

by
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- 6, line -8, space in front of comma
- 7, small correction in section 2.1.7:
the empty set is countable.
- 9, line -3, change to: (*) if x is minimal, or $P(y)$ holds for all $y < x$,
- 10, change paragraph after *CI* to: Note that if x is minimal, then there is no $y \in A$ such that $y < x$, and $(\forall y \in A)(y < x \supset P(y))$ is **true**. Hence, $P(x)$ has to be shown to be **true** for every minimal element x .
- 11, line -11, change “function over $\mathbf{N} \times \mathbf{N}$ ” to “function $A : \mathbf{N} \times \mathbf{N} \rightarrow \mathbf{N}$ ”
- 12, line 21, change “only” to “only if”
- 18, line 11, change A^* to Σ^*
- 19, change “charaterizing” to “characterizing”
- 25, line -14,-9,-5 and -2, change \leq to \preceq .
Line -10, A instead of M' . Line -6, change $<$ to \prec .
- 26, line 8, change $<$ to \prec .
- 27, in the hint of problem 2.3.3, add “in the Appendix”.
- 33, line 6, add “(in the Appendix)” after “theorem 2.4.1”.
- 39, in definition 3.3.3, add “(in the Appendix)” after “From theorem 2.4.1”
- 41, line -1, change “illustation” to “illustration”.
- 42, line 11, change “iff” to *iff*. Add “(in the Appendix)” after “by theorem 2.4.1”
Change definition 3.3.4 to define both a valid proposition and a tautology.
- 45, change \oplus to H_{\oplus} .
- 48, line 15, the formula can be simplified to $(A \supset (B \supset \perp)) \supset \perp$.
Add “(in the Appendix)” after “Subsection 2.4.1” and “Subsection 2.4.6”
- 50, line 3,6, use \neg instead of overline.
Add “(in the Appendix)” after “Subsection 2.4.1”
- 54, line 16, change to “a lot of effort has been spent”
- 57, in problem 3.3.11, the questions should be flush left.
- 58, line 5, delete “is ” in “proposition A' is in disjunctive ...”. In problem 3.3.14, change to: Let H_{\oplus} be the truth function ..., and in (i), change to: Prove that \oplus (*exclusive OR*) is commutative and associative.
- 69, add “of tree addresses” after “lexicographic order”
- 76, the last paragraph in example 3.4.7 is false. Instead, use the equivalent propositions $(P \vee Q) \wedge (\neg P \vee R)$ and $(P \vee Q) \wedge (\neg P \vee R) \wedge (Q \vee R)$ both in CNF.
- 78, line 1, “system” instead of “systems”.
- 79, in problem 3.4.8, change to: where H_{\oplus} is the binary truth function defined by the proposition $(P \wedge \neg Q) \vee (\neg P \wedge Q)$. Also, small spacing problem in line -14.
- 81, line -6, change G' to G' .
- 83, line 1, start a new paragraph at “In particular”. Line 10, change “ $\Gamma \rightarrow \Delta$ is an axiom” to “its label $\Gamma \rightarrow \Delta$ is an axiom.” Add “of tree addresses” after “lexicographic order”.
- 85, line 1, insert the sentence: “Note that a closed tree is finite by definition.”
- 89, change the first sentence of the proof of lemma 3.5.1 to: “We show that an infinite path can be defined inductively.”
- 91, line 6, add “(recall that a closed tree is finite)”. Line 15, change “premise” to “antecedent”, and “is is” to “is”. Line 16, change “conclusion” to “succedent”.
- 92, in theorem 3.5.1, delete the word “finite” in “finite closed tree”
- 93, line -12, change “lemma 3.5.1” to “lemma 3.5.2”. Line -9, change “premise” to “antecedent”, and “is is” to “is”. Line -8, change “conclusion” to “succedent”.
Line -7, change “lemma 3.5.2” to “lemma 3.5.3”.
- 94, in the proof of theorem 3.5.3, change “proposition” to “propositions”

95, in definition 3.5.10, should read: “A consistent set Γ ”

98, In problem 3.5.5, change A_n to A_{n+1} , and add “for the system $G' + \{cut\}$,” before “not using the completeness theorem”.

100, line -7,-8,-9, \mathcal{C} can be empty, see corrected page

101, line -8,-6, see corrected page

102, line -7, spaces around |

103, line -9,-12, change “problem 3.5.6” to “problem 3.5.7”

110, change the end of second paragraph to “not constructively, in the sense that the argument showing that there is a method for converting a proof with cut to a proof without cut is not effective.”

Line 6, change “beeing” to “being”.

112, line -1, change LK' to LK'

114, line 10, change “(1) is necessary” to “the second half of (1) holds”.

116, in problem 3.6.7, change LK to LK' . Change “Van Dalen, 1982” to “Van Dalen, 1980”

117, last three lines, this is not quite right, due to an error in Theorem 4.3.3

118, first paragraph, this is not quite right, due to an error in Theorem 4.3.3

125, problems 4.2.5 and 4.2.6 are not displayed properly.

126, line 15, change “than it is” to “as it is”.

129, line -11, extra parenthesis) in bottom sequent

132, change C_1, \dots, C_k to F_1, \dots, F_k , change C'_1, \dots, C'_p to F'_1, \dots, F'_p , change C''_1, \dots, C''_q to F''_1, \dots, F''_q , and $\{C''_1, B\}, \dots, \{C''_q, B\}$ to $\{F''_1, B\}, \dots, \{F''_q, B\}$.

137, in Theorem 4.3.3, the second statement is incorrect; the number of leaves of T may be more than the number of resolution steps in D .

137, add “Let $S = \{C_1, \dots, C_m\}$.” after *Proof*..

138, line -4,-5, this statement is wrong; the number of resolution steps in D may be more than $m_1 + m_2$

139, the end of the proof is wrong, since the number of resolution steps in D may be more than $m_1 + m_2$

142, Lemma 4.3.4 is wrong (because of an error in Theorem 4.3.3)

150, line 19, change “ n is the number” to “ n is the least number”. Line -9, change “s” to s

151, line -10, change “ n is the number” to “ n is the least number”

159, line -11, add the sentence: “For more details, see Section 10.3.2” before Definition 5.3.2.

163, line 17, change \mathbf{N} to \mathcal{N} .

170, change line 1 to “for all $i, 1 \leq i \leq n$. Hence,” 171, change line -5 to: “The following lemma for *renaming variables apart* will be needed later.”

173, line 12, change “proposition” to “tautology”.

174, line 4–5, change “those obtained ... are valid” to “they are valid”. Change the statement of lemma 5.3.5 to: “Let A be a formula obtained by substitution into a tautology as explained in definition 5.3.11. Then A is valid.”

176, line 10, change (10) to (11), and line 16, change (11) to (10). Add “(in the Appendix)” after “Subsection 2.4.6”

178, change “equivalence class of a proposition” to “equivalence class of a formula”.

In the definition of \mathbf{B}_L , change the overline operation to \neg .

179, in problem 5.3.2, change “Let A, B be any formulae, C, D any formulae not” to “Let A be any formula, C any formula not”. In problem 5.3.3, change D to A in fourth and fifth formula, left column.

181, 182, in problem 5.3.14, change “if x is not free in t ” to “if $x \notin \text{Var}(t)$ and t is free for x in A .” In problem 5.3.15, question (c)

is false. Add the definition of a strong homomorphism on page 181. Then, question (c) holds for strong homomorphisms. See corrected pages.

186, change the first sentence in problem 5.3.23 to: Given a first-order language \mathbf{L} , a *literal* is either an atomic formula or the negation of an atomic formula. A *basic Horn formula* is a disjunction of literals, in which at most one literal is positive.

Missing rightmost) in line -9

In problem 5.3.24, change C to \mathcal{C} .

190, line -15, change $\mathbf{a} = t_{\mathbf{M}}[s]$ to $a = t_{\mathbf{M}}[s]$.

195, in H3 and H4, the condition within parentheses should be “(we require that t is free for x in C (resp. in D) for every $t \in H$).”

200, 201, minor clarifications in the procedures, see corrected pages.

204, line 9, add “Recall that a closed tree is finite by definition.” Line 10, add the sentence: “Let $\Gamma \rightarrow \Delta$ be an input sequent in which no free variable occurs bound.” Line 11, delete “finite” in “finite closed”. Line 17, change “finite and closed” to “closed”. Line 20, change “theorem 3.4.1” to “theorem 3.5.1”

205, in the corollary, insert “in which no variable occurs both free and bound” between “sequent” and “(over”. In problem 5.4.2, change “Let A, B be any formulae, C, D any formulae not” to “Let A be any formula, C any formula not”. In problem 5.4.3, change D to A in fourth and fifth formula, left column.

206, change the first sentence in problem 5.4.8 to: Let $\Gamma \rightarrow A$ be a finite sequent, let x be any variable occurring free in $\Gamma \rightarrow A$, and let $\Gamma[c/x] \rightarrow A[c/x]$ be the result of substituting any constant c for x in all formulae in Γ and in A .

207, line 11, change (the x 's) to (the x 's)

208, line -3, change to “ L and R (as defined in subsection 3.5.2)”

209, 210, 211, minor clarifications in the procedures, see corrected pages.

213, in line 5, change $\langle f^3(y), nil \rangle$ to $\langle f^3(v), nil \rangle$; change the top line (line 11) of the proof tree to:

$$\Gamma', Q(y_1) \rightarrow Q(v), Q(f(v)), Q(f(f(v))), \\ Q(y_1), Q(f^3(v)), Q(f(y_1)), \exists z Q(z);$$

change line 17 to

$$\Gamma' = P(v), P(f(v)), P(f(f(v))), Q(y_1), \\ Q(f^3(v)), Q(f(y_1)), \forall x P(x).$$

214, line -8, add the sentence: “Let $\Gamma_0 \rightarrow \Delta_0$ be an input sequent in which no free variable occurs bound.” Line -7, delete “finite” in “finite closed”.

216, in the first corollary, insert “in which no variable occurs both free and bound” between “sequent” and “(even infinite)”.

218, line -8, should read: “A consistent set Γ ”

219, line 10, change “VanDalen, 1982” to “Van Dalen, 1980”.

224, in problem 5.5.14, change A_n to A_{n+1} .

231, in H3 and H4, the condition within parentheses should be “(we require that t is free for x in C (resp. in D) for every $t \in H$).”

Line -9, change to ... in $Pt_1 \dots t_n$.

233, line -7, change to ... in $Pt_1 \dots t_n$.

234, line 7, change to ... in $Ps_1 \dots s_n$.

236, line 1, change to ... in $FPt_1 \dots t_n$.

241, add “of tree addresses” after “lexicographic order”. Line -3, insert “and in which no free variable occurs bound” between “symbol” and “the following”.

242, line 1, delete “finite” in “finite closed”. Change Nelson and Oppen, 1980 to Kozen, 1976, 1977.

In the corollary, insert “in which no variable occurs both free and bound” between “sequent” and “(even infinite)”.

244, line 2, should read: “a consistent set Γ ”

246, in problem 5.6.5, change “if x is not free in t ” to “if $x \notin \text{Var}(t)$ and t is free for x in A .”

252, line 6, change to ... in $Qt_1\dots t_n$.

253, line 3, change to ... in $Qt_1\dots t_n$.

255, change “Van Dalen, 1982” to “Van Dalen, 1980”.

257, insert the following sentence just before the beginning of section 6.2: “In this Chapter, it is assumed that no variable occurs both free and bound in any sequent (or formula).”

266, change the statement of lemma 6.3.3 as follows: Every $G_{=}$ -proof tree T can be converted to a proof tree T' of the same sequent such that the rule applied to every sequent of the form $\Gamma \rightarrow A \wedge B, \Delta$ or $\Gamma, C \supset D \rightarrow \Delta$ is either the \wedge : *right* rule applied to the occurrence of $A \wedge B$ to the right of \rightarrow , or the \supset : *left* rule applied to the occurrence of $C \supset D$ to the left of \rightarrow . Furthermore, if T satisfies the conditions of lemma 6.3.1, then T' has the same depth as T .

275, line -8 (in subcase 2.1), change “in A ” to “in $\forall xA$ ”;

279, line -8, change T'_2 to T'_1

283, line 6, change “axioms” to “provable (with no essential cuts) sequents”;

line 9, change Q to P :

$$\Gamma', \Lambda', s_1 \doteq r_1, \dots, s_n \doteq r_n, Ps_1\dots s_n \\ \rightarrow \Delta', \Theta', Pr_1\dots r_n$$

290, line -2, change “in in ” to “in”.

294, line 12, “stronger” for “stonger”.

295, line 16, change “and” to “iff”.

300, In section 6.7, it is necessary to assume that $\mathbf{L} = \mathbf{L}_1 \cap \mathbf{L}_2$, especially in the statement of theorem 6.7.1. See corrected page.

301, small correction in the proof. In the middle of the page, C belongs to \mathbf{L} because $\mathbf{L} = \mathbf{L}_1 \cap \mathbf{L}_2$. See corrected page.

302, line -2, change “reader if” to “reader is”.

It is necessary to assume that $\mathbf{L} = \mathbf{L}_1 \cap \mathbf{L}_2$ in problem 6.7.1. See corrected page.

305, insert the following sentence just before the beginning of section 7.2: “In this Chapter, it is assumed that no variable occurs both free and bound in any sequent (or formula).”

306, line -2, change “ y is not free” to “ x is not free”

322, first line of example 7.3.3, $m(T) = 2$ and $n(T) = 0$ instead of $n(T) = 2$ and $m(T) = 0$.

327, in definition 7.4.3, the axioms must be of the form $A \rightarrow A, \rightarrow A, \neg A, A, \neg A \rightarrow,$ and $\neg A \rightarrow \neg A$, where A is atomic.

335, the end of the proof of theorem 7.4.1 is incorrect. The correct proof is similar to the proof of theorem 7.3.1, see corrected page.

337, line -1,-2,-3, missing “in the”

356, in formula (*), $P(a)$ should be $P(x)$.

357, line -9, change end of line to “of all the pairs $\langle \exists xB, L \rangle$ ”.

358, in definition 7.6.2, clause (ii), the word “form” is missing after “of the ”.

361, line -7, in the statement (*), “satisfiable” should be “unsatisfiable”.

366, line 10, change “mistakingly” to “mistakenly”. Line 20, change “intutive” to “intuitive”.

368, line -3, change \mathbf{L}' to \mathbf{L}' .

373, line -3, change “an (tedious)”, to “a (tedious)”.

379, in line -7, extra parenthesis in C_3 , change to $C_3 = (P(f(z_3), z_3) \vee P(z_3, a))$.

381, line -13, change G_1 to C_1 .

Line -10, change “with support the union of the set” to “having as support the union of the sets”.

382, corrections in definition 8.4.1 and 8.4.2 (definition of the composition of substitutions)

383, corrections in lemma 8.4.2

384, last two lines of old page 383 now on top of page 384.

389, minor format change.

391, in line 14, change “is in s_0 or t_0 ” to, “is in $\sigma(s_0)$ or $\sigma(t_0)$ ”. Change line -4 to: “(i) Assume that s is a constant and t is not a variable, ...”

392, line 20,21, change i to $i - 1$. Line 24, change “ i -th” to “ $(i - 1)$ -th”.

394, change Kapur, Krishnamoorthy, and Narendran, 1982 to Martelli and Montanari, 1982. Change “Siekman” to “Siekmann”

397, line 9, change to $\sigma = (a/z_1, a/z_2, a/x)$; line -4, add “the” before “resolvent”.

398, line 9, in C_3 , extra parenthesis) after z_3 . It should be,

$(C_3 = \{P(f(z_3), z_3), P(z_3, a)\})$

400, line 2, change “prove that” to “prove the”. In lemma 8.5.3, change 2nd sentence to “two substitutions such that $\sigma_1(A)$ and $\sigma_2(B)$ are ground,”

401, in lemma 8.5.4, several occurrences of h should be F . Also change to: “and if the clause C (not necessarily in S_g) is the label of u , then $h(u)$ is labeled by the clause $\theta(C)$, where θ is some ground substitution.”

In (ii), change $\sigma_1(A)$ to A' and $\sigma_2(B)$ to B' .

402, inaccurate proof. See corrected page.

403, see corrected page. Also, extra) in C_3 and G_3 .

405, in problem 8.5.1, missing comma after y in $\{P(x, y, f(z))\}, \{P(y, z, f(z))\}$

408, line 13, missing (

409, change “Siekman” to “Siekmann”, and “Andrews, 1970” to “Andrews, 1971”.

Before “For details ...”, Add the sentence: “It can also be shown that paramodulation is complete without the functional reflexivity axioms, but this is much harder.”

410, add “a variant of Model Elimination (Loveland, 1978)”, in line 11.

419, line -8, change “9.2.2” to “9.2.1”

424, line 2, change $0 < i < p$ to $0 \leq i < p$.

429, line 1, change $0 < i < p$ to $0 \leq i < p$.

441, In theorem 9.5.1, change H_{i_1}, \dots, H_{i_k} , to C_{i_1}, \dots, C_{i_k} , see corrected page.

442, error in the Corollary, see corrected page.

445, error in proof at the top of the page.

Change top paragraph to:

such that for every pair of clauses N_i'' in \mathcal{R} and N_i' in \mathcal{R}_g , $N_i' = \eta_i(N_i'')$, for some ground substitution η_i . Let $\eta = \eta_r$, and let σ be the result substitution of the SLD-refutation \mathcal{R} . It can be shown that $(\neg B_1 \vee \dots \vee \neg B_n)[t_1/z_1, \dots, t_q/z_q] = (\sigma \circ \eta)(\neg B_1 \vee \dots \vee \neg B_n)$, which shows that $(t_1/z_1, \dots, t_q/z_q)$ is equal to the restriction of $\sigma \circ \eta$ to z_1, \dots, z_q .

Line -4, no space after “Van Emden”

447, additional new problem 9.5.7, see corrected page.

Line -10, add “itself a derivative of Model Elimination (Loveland, 1978)”. Line -2, no space after “Van Emden”

448, change Nelson and Oppen (Nelson and Oppen, 1980) to Kozen (Kozen, 1976, 1977).

449, in definition 10.2.1, under *Quantifiers*, change “rank ($s, bool$)” to “rank ($bool, bool$)”.

450, replace line -14,-15 by:

and the functions $A_i^s, E_i^s : \Gamma_{bool} \rightarrow \Gamma_{bool}$ (of rank ($bool, bool$)) are defined such that, for any string A in Γ_{bool} ,

454, 455, clearer presentation, see corrected pages

456, line 7, change second “iff” to “iff”

460, line -4, add “Kozen (Kozen, 1976, 1977) and”

461, change “conjunct” to “disjunct” in line 9.

Line 16, add “Kozen (Kozen, 1976, 1977) and”. Line 20, add “Kozen and”.

464, see corrected page (added \mathcal{E})

465, mistakes in proof, see corrected page
 468, see corrected page (added \mathcal{E})
 469, mistakes in proof, see corrected page
 470, mistakes in proof, see corrected page
 473, line 1, $R_1 \cup R_2$ instead of $R_1 \cup X \times Y$,
 line -6, “is a variable” instead of “has arity”
 e
 474, line 1, $1 \leq i \leq n$ instead of $1 \leq n \leq n$
 475, line 1, “is a variable” instead of “has
 arity” e . Correction at the end of problem
 10.6.8, see corrected page.
 476, line -6, change to “Congruence closure
 algorithms were first discovered by Kozen
 (Kozen, 1976, 1977), and independently a
 few years later by”
 480, in (2) and (3), additions, see corrected
 page.
 481, correction in the statement of lemma
 2.4.2.
 486, in (2) and (3), additions, see corrected

page.
 487, line 1, change “if a” to “is a”. Para-
 graph after 2.5.9, error in the definition of
 a many sorted tree. See corrected page.
 Also, correction in the statement of lemma
 2.5.1.
 Change “Andrews, 1970” to “Andrews,
 1971”
 491, line 17, “*Logical Writings*” (missing
 “s”).
 Delete Kapur et al., 1982.
 Add Kozen, 1976, and Kozen, 1977.
 492, add Martelli, and Montanari, 1982.
 493, line -6, bad looking ö in “Gödel”.
 Change “Siekman” to “Siekmann”.
 499, Definition 10.3.5 is now on page 455
 506, Space needed between the “I group”
 and the “L group”.
 507, error in index, “most general unifier”
 misplaced