

Logic in Computer Science  
Modelling and reasoning about systems\*

Errata for the First Printing  
of the **Second** Edition

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Readers of this book are kindly requested to notify Mark Ryan (email: `mdr@cs.bham.ac.uk`) of errors they find. These will be included in this file, and incorporated into future printings of the book.

New items (since January 2009) are marked with an asterisk.

- \* • p. xiii. 1.2. “serveral”  $\rightarrow$  “several”
- p. 20. 1.-2. After the paragraph ending with the word “negation”, add the sentence: “The formula  $\perp$  stands for the contradiction.”.
- p. 21. 1.17. “The fact that  $\perp$ ”  $\rightarrow$  “The fact that  $\perp$  (the contradiction)”.
- \* • p. 22. 1.10. Delete “with a contradictory formula as sole premise”
- \* • p. 26. 1.3. “ $\neg p \vee p$ ”  $\rightarrow$  “ $p \vee \neg p$ ”
- p. 31. 1.14. “ $b$  is rational or it is not”  $\rightarrow$  “ $b^b$  is rational or it is not”.
- p. 47. “This is a proof of the sequent  $p \wedge q \rightarrow r, p \vdash p \rightarrow r$ .” The  $p \rightarrow r$  should be  $q \rightarrow r$ . The same mistake should be corrected in the line below as well.
- \* • p. 49. 11.4-9. Replace “ $\phi_1, \phi_2, \dots, \phi_2 \vdash \psi$ ” with “ $\phi_1, \phi_2, \dots, \phi_n \vdash \psi$ ” (three occurrences).
- p. 53. Corollary 1.39, in the second sentence: “is holds” should be “holds”.

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\*Cambridge University Press, June 2004.

- p. 57. Definition 1.44. “a valuation in which is”  $\rightarrow$  “a valuation in which it”
- p. 68. 1.3. “has be to true”  $\rightarrow$  “has to be true”
- p. 68. Section 1.6, in the first sentence of the first paragraph: “formule” should be “formula”.
- \* • p. 100. 1.20. “ $n \geq 1$ ”  $\rightarrow$  “ $n \geq 0$ ”
- p. 120. 1.6. “assumption” should be “premise”.
- \* • p. 122. 1.6. “ $\forall x$  i 5”  $\rightarrow$  “ $\exists x$  i 5”
- \* • p. 122. 1.7. “ $\forall y$  i 6”  $\rightarrow$  “ $\exists y$  i 6”
- \* • p. 122. 1.34. (penultimate line). “assertions of the form ‘ $\Gamma \vdash \phi$  is not valid.’ ”  $\rightarrow$  “assertions of the form ‘ $\Gamma \vdash \psi$  is not valid.’ ”
- p. 134, 1-12: “verify that is” should be “verify that it”.
- \* • p. 135. 1.20. “we know that for all  $(s, t) \in P\mathcal{M}'$ ”  $\rightarrow$  “we know that for all  $(\text{interpret}(s), \text{interpret}(t)) \in P\mathcal{M}'$ ”
- \* • p. 151. 1.10. “obtained by removing  $c$  from the PDS  $P$ ”  $\rightarrow$  “obtained by adding  $c$  to the PDS  $P$ ”
- \* • p. 158. Exercise 2.1.5.f. “syymetric and asymmetric”  $\rightarrow$  “symmetric and asymmetric”
- \* • p. 159. Exercise 2.2.1. “ $f$  a function symbol with two arguments and  $g$  a function symbol with three arguments.”  $\rightarrow$  “ $f$  a function symbol with three arguments and  $g$  a function symbol with two arguments.”
- p. 161. Exercise 2.3.9. Replace  $S(y)$  by  $Q(y)$ , twice.
- \* • p. 162. 1.-8, exercice 13(h), Replace “ $\forall y$ ” by “ $\forall x$ ”.
- p. 165. 1.18. “In Example 2.23, page 136”  $\rightarrow$  “In Example 2.27, page 140”.
- \* • p. 166. 1.5.  
“ $\exists P(\forall x \forall y P(x, y) \rightarrow \neg P(y, x)) \wedge (\forall u \forall v R(u, v) \rightarrow P(v, u))$ ”  
 $\rightarrow$   
“ $\exists P(\forall x \forall y (P(x, y) \rightarrow \neg P(y, x)) \wedge \forall u \forall v (R(u, v) \rightarrow P(v, u)))$ ”.

- p. 166. 1.6.  

$$\begin{aligned} & \text{“}\forall P(\exists x\exists y\exists zP(x,y)\wedge P(y,z)\wedge\neg P(x,z))\rightarrow(\forall u\forall vR(u,v)\rightarrow P(u,v))\text{”} \\ & \rightarrow \\ & \text{“}\forall P(\exists x\exists y\exists z(P(x,y)\wedge P(y,z)\wedge\neg P(x,z))\rightarrow\forall u\forall v(R(u,v)\rightarrow P(u,v)))\text{”}. \end{aligned}$$
- p. 166. 1.7.  

$$\begin{aligned} & \text{“}\forall P(\forall x\neg P(x,x))\vee(\forall u\forall vR(u,v)\rightarrow P(u,v))\text{”} \\ & \rightarrow \\ & \text{“}\forall P(\forall x\neg P(x,x)\vee\forall u\forall v(R(u,v)\rightarrow P(u,v)))\text{”}. \end{aligned}$$
- p. 181 1.-4. The expression ‘clause 11’ should be ‘clause 13’.
- \* • p. 184. 1.6. “Whatever happens”  $\rightarrow$  “On all paths”;  
“be permanently”  $\rightarrow$  “become”
- p. 191. Figure 3.8. There is no state  $s_8$ , so one should rename  $s_9$  to  $s_8$  in the figure and in the text.
- \* • p. 196. Figure 3.10. 1.15. Replace  

$$(!pr1.st=c \ \& \ G \ !pr1.st=c \ | \ ((!pr1.st=c) \ U \ pr2.st=c))$$
with  

$$!(pr1.st=c) \ \& \ G \ !(pr1.st=c) \ | \ ((!(pr1.st=c)) \ U \ pr2.st=c))$$
- \* • p. 215. 1.19. (“Whatever happens, a certain process...”)  
To that bullet, add a sentence:  
“Note that this formula is stronger than FG deadlock considered in section 3.2.3.”
- \* • p. 221. 1.21. “ $\neg p \ W \ q$ ”  $\rightarrow$  “ $\neg q \ W \ p$ ”  
“ $\neg(\neg q \ U \ (p \wedge \neg q))$ ”  $\rightarrow$  “ $\neg(\neg p \ U \ (q \wedge \neg p))$ ”
- \* • p. 223. 1.8. Delete “change  $\phi$  to the output of TRANSLATE( $\phi$ ), i.e. we” (i.e. it will be: “First, write  $\phi$  in terms of...”)
- \* • p. 228. 1.21. (in function SAT<sub>EX</sub>). Append a semicolon to the end of the line:  
“ $Y := Y \cup pre_{\forall}(Y)$ ”
- \* • p. 229. 1.11. (in function SAT<sub>EU</sub>). Append a semicolon to the end of the line:  
“ $Y := Y \cup (W \cap pre_{\exists}(Y))$ ”

- \* • p. 230. on both 1.24 and 1.28. “ $FG\neg c_2 \rightarrow \phi$ ”  $\rightarrow$  “ $GF\neg c_2 \rightarrow \phi$ ”
- \* • p. 235. 1.24. “each of  $q_1, q_2, q_3$  can transition to any valuation”  $\rightarrow$  “each of  $q_1, q_2, q_4$  can transition to any valuation”
- \* • p. 240. 1.10. (in function  $SAT_{EG}$ ). Append a semicolon to the end of the line:  
“ $Y := Y \cap \text{pre}_{\exists}(Y)$ ”
- p. 246. 1.9. “Definition 3.1 (page 175)”  $\rightarrow$  “Definition 3.6 (page 180)”.
- p. 248. 1.-10. “ $E(t \text{ U } q)$ ”  $\rightarrow$  “ $E[t \text{ U } q]$ ”.
- \* • p. 249. 1.7. (list item h).  
“ $\llbracket A(\phi_2 \text{ U } \phi_2) \rrbracket = \llbracket \neg(E(\neg\phi_1 \text{ U } (\neg\phi_1 \wedge \neg\phi_2)) \vee EG\neg\phi_2) \rrbracket.$ ”  $\rightarrow$   
“ $\llbracket A(\phi_1 \text{ U } \phi_2) \rrbracket = \llbracket \neg(E(\neg\phi_2 \text{ U } (\neg\phi_1 \wedge \neg\phi_2)) \vee EG\neg\phi_2) \rrbracket.$ ”
- p. 251. Exercise 3.6.1. Replace “ $\phi_1$  to  $\phi_4$ ” by “the formulas for safety, liveness and no-strict-sequencing given on page 189”.
- \* • p. 271. 1.5. “ $(\psi) x = 5 (\psi[x/E])$ ”  $\rightarrow$  “ $(\psi) x = 5 (\psi[E/x])$ ”  
1.7. “ $\psi[x/E]$ ”  $\rightarrow$  “ $\psi[E/x]$ ”
- p. 302, exercise 20: ”at the and”  $\rightarrow$  ”at the end”.
- \* • p. 303. Exercise 4.4.1.f. “ $\neg(y = 0)$ ”  $\rightarrow$  “ $(y > 0)$ ”
- \* • p. 304. Exercise 4.5.2. (In function *withdraw*). “amount  $< 0$ ”  $\rightarrow$  “amount  $> 0$ ”
- p. 321, 1.5 of main text (not the table): “linear” should be “forwards linear”.
- p. 325, Table 5.12, last line: “linear” should be “forwards linear”.
- p. 337 1.-5: “a frame...is said to satisfy  $\phi$ ” should be “a frame...is said to validate  $\phi$ ”.
- p. 322, 1.-4: “the frame, as a whole, satisfies a formula”. The word “satisfies” should be “validates”.  
1.-2: “satisfies a formula” should be “validates a formula”.
- p. 323, 324, 325: Every occurrence of “satisfy”, “satisfies”, etc., should be “validate”, “validates”, etc., *except the following ones*:

- p.323, l.-2: “each world satisfies”
- p.325, l.4 (of main text, not of Table 5.12): “ $x$  satisfy  $p$ ”.
- p.325, l.5 (of main text, not of Table 5.12): “ $x$  satisfy  $p$ ”.
- p.325, l.12 “satisfies  $\Box\phi$ ”.
- p. 326, l.4. Between the sentence ending “hand.” and the next one beginning “Some”, insert the following text. “A *modal logic* will be defined by stipulating a set  $\mathbb{L}$  of formula schemes.
- p. 326, l.10. Change item 3 to the following text.
 

$\Gamma$  *semantically entails*  $\psi$  in  $\mathbb{L}$  iff for all models whose frames validate  $\mathbb{L}$ , and for all worlds  $x$  in the model, we have that if  $x$  satisfies  $\Gamma$  then  $x$  satisfies  $\psi$ . In that case, we say that  $\Gamma \vDash_{\mathbb{L}} \psi$  holds.
- p. 326, l.12–15: The entire parragraph beginning “Thus” and ending “be” should be replaced with
 

Note that for  $\mathbb{L} = \emptyset$  this definition is consistent with the one of Definition \ref{mod:sement} (Definition 5.15), since the requirement on frames is vacuous. For logic engineering, we require that a modal logic  $\mathbb{L}$  be
- p. 326, l.20: Add to the two bullet points, the following two:
  - closed under necessitation, i.e. for every formula  $\phi$  in  $\mathbb{L}$ , we also have that  $\Box\phi$  is in  $\mathbb{L}$ ; and
  - closed under Modus Ponens, i.e. for every formulas  $\phi$  and  $\phi \rightarrow \psi$  in  $\mathbb{L}$ , we also have that  $\psi$  is in  $\mathbb{L}$ .
- \* • p. 343. l.23. “ $(\neg K_2 p_2, \wedge \neg K_2 \neg p_2)$ ”  $\rightarrow$  “ $(\neg K_2 p_2 \wedge \neg K_2 \neg p_2)$ ” (i.e. delete the comma)
- \* • p. 353, l.11: “does not satisfy” should be “does not validate”.  
l.13: “does satisfy” should be “does validate”.
- p. 353. Exercise 5.6.18.b. “Show that  $\vDash_{KD45}$ ”  $\rightarrow$  “Show that  $\vDash_{KT45}$ ”
- p. 407. Figure 6.32(a). The edge between  $s_1$  and  $s_3$  should be directed from  $s_1$  to  $s_3$ .

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