

Artificial Intelligence: A New Synthesis
Errata and Clarifications
March 1, 2000

Errors in earlier printings that have been corrected in the third printing (September 1999)

1. In step 6 on page 142 and on page 143 (both places) add the sentence “Put these members of \mathcal{M} on *OPEN*.”
2. In the third equation on page 176, the last n_i should be replaced by n_j .
3. On the bottom of page 184, replace the sentence “The arcs in Figure 11.4 are consistent if there is a solution to the Four-Queens problem.” with “The arcs in Figure 11.4 are consistent because for each pair q_i and q_j ($i \neq j$) and for each value of q_i there is a value of q_j that does not violate the constraint.”
4. On the bottom of page 187, replace the sentence “The operators change a data structure so that it violates fewer constraints” with “The operators produce a new data structure that corresponds to a different proposed solution.”
5. Figure 12.3 on page 200 has a minor error in the tic-tac-toe board that is third from the bottom of the figure. The circle in that board should be one cell immediately below the position shown. (The evaluation of that board, namely $6 - 5 = 1$, is correct.
6. The mention of the deduction theorem, stated on the bottom of page 228, should also include “and vice versa.”
7. In the two formulas in the middle of page 249, replace “Inroom($y, 28$)” with “Inroom($y, 29$)”
8. Exercise 17.4 on page 299 has a typographical error. “ W_3 ” should be replaced by “ W_4 ”.

9. The formula at the top of page 308 should be replaced by:

$$\begin{aligned}
 & (\forall y) \{ \text{Occurs}(\text{Flow}, y) \\
 & \supset (\exists x, z) [\text{Occurs}(\text{Turn_ccw}, x) \wedge \text{Occurs}(\text{Turn_cw}, z) \wedge \text{Overlaps}(x, y) \\
 & \wedge \text{Overlaps}(y, z)] \}
 \end{aligned}$$
10. A better statement of step 3 on page 365 would be:

“Express the effects of actions by wffs. In some formulations ...”
11. Two co-authors were omitted in the Schaeffer, et al. 1992 bibliographic entry on page 485. At the end of the list of authors listed, add Lu, P., and Szafron, D.

Additional errors to be corrected in subsequent printings

1. There is an error in Figure 2.1, page 22. The robot at the lower left would actually move clockwise not counterclockwise as the figure claims. If it were re-positioned one cell upward, it would then move counterclockwise.
2. On page 289, the value for r_{RATING} should be $1/3 = 0.33$ instead of 0 in the equations just under Table 17.2. This error requires a modification to the paragraph just below these equations. Replace the paragraph that begins with “Again, a tie. ...” with the following paragraph:

“The largest is r_{RATING} , which gives us the rule $\text{RATING} \supset \text{OK}$. This rule covers negative instances 5 and 9, so we must add another atom to the antecedent. The r 's are”

We also have to change the equations just below that paragraph. The new equations are:

$$r_{\text{APP}} = 1/2 = 0.5$$

$$r_{\text{INC}} = 1/2 = 0.5$$

$$r_{\text{BAL}} = 0/0$$

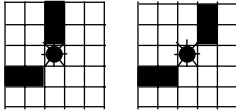
- The first paragraph of page 329 should be replaced by:

Now we calculate $p(\neg M|\neg L) = 0.9525$ (using causal reasoning) and compute $p(\neg L|\neg M) = \frac{0.9525 \times 0.3}{p(\neg M)} = \frac{0.28575}{p(\neg M)}$. Similarly, $p(L|\neg M) = \frac{p(\neg M)Lp(L)}{p(\neg M)} = \frac{0.145 \times 0.7}{p(\neg M)} = \frac{0.1015}{p(\neg M)}$. Since these two expressions must sum to 1, $p(\neg L|\neg M) = 0.7379$.

Please let the author know of any other errors (nilsson@cs.stanford.edu).

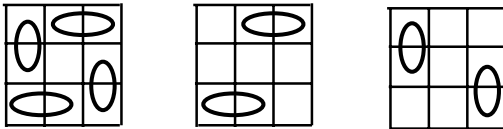
Clarifications that will be dealt with in any revised edition

- The “no-tight-space” condition mentioned on page 21 of the text is ambiguous. Intuitively, the condition attempts to rule out configurations, such as the ones shown below, in which the the robot would be confused about which boundary to follow:

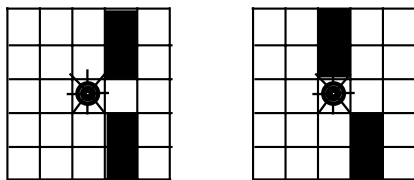


Since there are many such confusing configurations, the condition is difficult to state succinctly. But note that the robot perceives the world only through the values of the features x_1, x_2, x_3 , and x_4 , defined on page 24. Thus it suffices to define the no-tight-space condition in terms of those features alone.

First, I define the conditions diagrammatically as follows. We rule out any configurations in which *each* of the sets of cells marked by ellipses in the diagrams below have one or more cells occupied and in which the other cells are empty. That is, we rule out any configurations for which the Boolean function $x_1x_2x_3x_4 + x_1x_3\bar{x}_2\bar{x}_4 + x_2x_4\bar{x}_1\bar{x}_3$ has value 1.



Note that the following configurations are among those that are not ruled out by this condition:



The reader might justifiably complain that these configurations contain “tight spaces,” but they are invisible to the robot’s perceptual apparatus and cause no confusion about which action should be executed.

2. The non-recursive Tower-of-Hanoi algorithm stated in Exercise 5.3 (page 81) is overly complex. There is a much simpler, stateless algorithm. In the simpler one, we stipulate that D_3 and D_1 must always move clockwise, and that D_2 must always move counter-clockwise. We always move the largest disc that can be moved in its stipulated direction. Assume that disc can be sensed by sensory features B_1 , B_2 , and B_3 . B_i has value 1 if and only if disc D_i is the largest disk that can be moved in its stipulated direction. (Otherwise it has value 0.) The exercise should be replaced by one that asks for a production system that uses these features and implements the simple algorithm.
3. Section 17.3 (*Maintenance in Dynamic Knowledge Bases*) is an overly brief description of truth maintenance and its various applications in reasoning and problem solving. Future editions of the book will expand on this topic. In the meantime, the reader should consult some of the references listed on page 298.
4. On page 422, Austin should be credited with inventing the idea of speech acts. (Austin, J., *How to do Things with Words*, Cambridge, MA: Harvard University Press, 1962.)
5. The fact that “. . . speakers do not usually send redundant information” (stated in the middle of page 437) is one of a set of *conversational postulates* that most language users are presumed to follow. For more on conversational postulates, see Grice, H., “Logic and Conversation,” in Cole, P., and Morgan, J., (eds.), *Studies in Syntax, Vol. III*, New York: Seminar Press, 1975.