Errata

in the book

Klaus Weihrauch, Computable Analysis

Springer, Berlin, 2000

(edited by the author)

Last update: 15 Jan 2005 , correct text is included in $[\![\quad]\!]$.

p.VII **l.-11 :** $[\![$ ... by A. Turing [Tur36], ... $]\!]$

p.2 **l.-13 :** $[\![$ ... R. L. Goodstein [Goo59], ... $]\!]$

p.2 **l.-9 :** $[\![$ ... and S. Smale [... $]\!]$

p.4 **l.-4 :** $[\![$ ... $(f(n) + 1)$ ... $]\!]$

p.7 **l.-1 :** $[\![$ **Fig. 1.4.** Characteristic function and distance function of $[0; 1]$. $]\!]$

p.8 **l.9 :** replace "boundaries" by $[\![$ endpoints $]\!]$.

p.10 **l.17 :** $[\![\, x := \sum_{k=n}^{-\infty} a_k \cdot 2^k \,]\!]$

p.11 **l.20 :** $[\![\, (i = 1, \ldots, k) \,]\!]$

p.11 **l.-18 :** replace "$f[\{a\}] \subseteq \mathrm{dom}(B)$" by $[\![\, f[\{a\}] \subseteq \mathrm{dom}(g) \,]\!]$

p.19 **l.-1 :** add: $[\![$ More general tuplings are defined straightforwardly, e.g., $\langle x, p, z\rangle := \langle\langle x, p\rangle, z\rangle$ for $x, z \in \Sigma^*$ and $p \in \Sigma^\omega$. $]\!]$

p.20 **l.18 :** $[\![\, f :\subseteq Y \times Y \times \ldots \,]\!]$

p.30 l.-10 : insert after “is open”: ⟦ in dom(f) ⟧

p.30 l.-8 : ⟦ computation ⟧

p.30 l.-4 : insert before “contained in”: ⟦ realative to dom(f) ⟧

p.30 l.-3 : replace: ⟦ Therefore, $f^{-1}[w\Sigma^\omega]$ is open in dom(f). ⟧

p.45 l.13 : ⟦ **(union intersection, complement, preimage).** ⟧

p.46 l.2 : cut: “and $f^{-1}[W]$ is r.e. open”

p.52 l.24 : ⟦ $\mathrm{En}(p) := \{n \in \mathbb{N} \mid \mathtt{1}\mathtt{0}^{n+1}\mathtt{1} \lhd \mathtt{p}\}$. ⟧

p.54 l.9 : ⟦ , i.e., ⟧

p.54 l.-7 : ⟦ Let ν and ν' be notations ... ⟧

p.54 l.-1 : ⟦ $f :\subseteq M \to M'$ ⟧

p.65 l.5 : ⟦ $\delta_{\mathbf{S}'} \equiv \delta_{\mathbf{S}}$ ⟧

p.67 l.11 : replace the proof of 1. by:
⟦ It suffices to prove that $\delta_{\mathbf{S}}^{-1}[A]$ is open in dom(δ_{S}) for all $A \in \sigma$. We have $\delta_{\mathbf{S}}^{-1}[A] = \{p \in \Sigma^\omega \mid (\exists w \in \nu^{-1}[A]\ \iota(w) \lhd p\} \cap \mathrm{dom}(\delta_{\mathrm{S}})$. The first set is $\bigcup_{\nu(w)=A} \Sigma^*\iota(w)\Sigma^\omega$, hence an open set. Therefore, $\delta_{\mathbf{S}}^{-1}[A]$ is open in dom(δ_{S}). ⟧

p.73 l.13 : replace [Sch00] by ⟦ [Sch01] ⟧which is
Schröder, Matthias, Admissible Representations of Limit Spaces, in: Computability and Complexity in Analysis, Blanck, Jens and Brattka, Vasco and Hertling, Peter (eds.), LNCS 2064, 273–295, Springer, Berlin, 2001.

p.74 l.11 : ⟦ Let ν be a notaion with r.e. domain. Show that there is some ... ⟧

p.86 l.10 : no linebreak

p.90 l.16 : $[\![$ the real numbers such that for rational numbers a, the properties ... $]\!]$

p.91 l.17 : no linebreak

p.92 l.-5 : $[\![$ ... *infinite base-n fractions* ... $]\!]$

p.97 l.11 : replace "(δ, δ)" by $[\![$ $[\delta, \delta]$ $]\!]$ in Line 11 (twice)

p.97 l.12 : replace the proof as follows:
$[\![$ Assume that the relation "$x = y$" is $[\delta, \delta]$-open. By Def. 3.1.3.2, $[\delta, \delta]^{-1}\{(x, y) \mid x = y\} = U \cap \mathrm{dom}[\delta, \delta]$ for some open $U \in \Sigma^\omega$. Consider $z = \delta(p)$. Then $\langle p, p\rangle \in U$. Since U is open, $\langle p, p\rangle \in w\Sigma^\omega \subseteq U$ for some $w \in \Sigma^*$. Then $\langle v\Sigma^\omega, v\Sigma^\omega\rangle \subseteq w\Sigma^\omega \subseteq U$ for some $v \in \Sigma^*$ such that $p \in v\Sigma^\omega$. For any $q \in v\Sigma^\omega \cap \mathrm{dom}(\delta)$, $\langle p, q\rangle \in \langle v\Sigma^\omega, v\Sigma^\omega\rangle \subseteq w\Sigma^\omega \subseteq U$, hence $\delta(p) = \delta(q) = x$. Therefore, $\delta[z\Sigma^\omega] = \{z\}$. As we have shown, for every $z \in \mathbb{R}$ there is some $w \in \Sigma^*$ such that $\delta[w\Sigma^\omega] = \{z\}$. But this is impossible, since Σ^* is countable but $\mathbb{R}$ is uncountable. If "$x \leq y$" is $[\delta, \delta]$-open, then also "$x \geq y$" is $[\delta, \delta]$-open, hence "$x = y$" is $[\delta, \delta]$-open by Thm. 2.4.5 (contradiction). Finally, if "$x < y$" is $[\delta, \delta]$-clopen, then "$x \geq y$" is $[\delta, \delta]$-open (contradiction). $]\!]$

p.97 l.-3 : $[\![$ ... substituting the n- $]\!]$

p.100 l.-11 : replace [BH00] by $[\![$ [BH02] $]\!]$which is
Brattka, Vasco and Hertling, Peter, Topological properties of real number representations, TCS 284.2, 2002, 241-257

p.102 l.14 : replace 2^n by $[\![$ 2^{n+1} $]\!]$ (twice)

p.112 l.-12 : replace a by $[\![$ c $]\!]$, also in the figure.

p.120 l.-8 : $[\![$ ... Definition 3.1.2). $]\!]$

p.128 **l.-11 :** replace "(Exercise 4.1.21)" by ⟦ (Def. 4.1.21 and Exercise 4.1.21). ⟧

p.136 **l.-14 :** linebreak before ⟦ Since a set ...⟧

p.140 **l.22 :** replace ψ by ⟦ $\psi_<$ ⟧

p.142 **l.-5 :** ⟦ ... is a recursive ... ⟧

p.148 insert before **l.11 :** ⟦ Notice that κ_{H} is admissible w.r.t. the Hausdorff topology on $\mathcal{K}^*$. ⟧

p.154 **l.-15 :** ⟦ ... function is ... ⟧

p.157 **l.1 :** continue ⟦ for r.e. open sets A. $\delta^A_{\to}$ and δ^A_{oo} are equivalent for r.e. closed sets A. ⟧

p.157 **l.-4 :** linebreak after ⟦ ... translates δ^A_{oo} to δ^A_{co}. ⟧

p.172 **l.7 :** in the denominators replace $1 + f_i$ by ⟦ $1 + |f_i|$ ⟧ and $1 + f_i(x)$ by ⟦ $1 + |f_i(x)|$ ⟧.

p.179 **l.-12, -11 :** replace "is non-negative ... $> 1/2$." by ⟦ is non-negative, computable and has no computable zero. Its set of zeroes has Lebesgue measure $> 1/2$. ⟧

p.180 **l.-17 :** ⟦ Finding the *position* of the maximum value ... ⟧

p.190 **l.14 :** ⟦ ... its restriction to ... ⟧

p.191 **l.17, 19 :** ⟦ $\{z \in \mathbb{C} \mid |z| < R\}$ ⟧

p.209 **l.-15 :** ⟦ which on input $p = \iota(u_0)\iota(u_1)\ldots \in \mathrm{dom}(\rho^a)$ determines ... ⟧

p.228 **l.-3 :** replace "every rational" by ⟦ On every compact subset of its domain, every rational ⟧

p.232 **l.4 :** ⟦ ... can be encoded by a quadratic boolean matrix ... ⟧

p.233 **l.-4 :** ⟦ (see Fig. 7.6). ⟧

p.238 **l.3 :** ⟦ First we show that δ is (τ_C, τ)-continuous, where τ is the metric topology on M. Since ... ⟧

p.238 **l.21 :** ⟦ ... in dom(δ and δ is continuous, ⟧

p.239 **l.10 :** insert before ⟦ Definition ⟧: ⟦ If $\alpha \equiv \alpha'$ for effective metric spaces $\mathbf{M} = (M, d, A, \alpha)$ and $\mathbf{M}' = (M, d, A, \alpha')$, then $\delta_{\mathbf{M}} \equiv \delta_{\mathbf{M}'}$. Furthermore, for every notation α with r.e. domain there is an equivalent one with recursive domain (Exercise 3.2.15). Therefore, for semi-computable and computable metric spaces we may assume w.l.o.g. that dom(α) is recursive. ⟧

p.239 **l.-4 :** replace "computable" by ⟦ effective ⟧

p.239 **l.-2 :** ⟦ ... and **S** is a computable ... ⟧

p.239 add to **Thm. 8.1.4 :** ⟦ 3. $\delta_{\mathbf{M}}$ is admissible (w.r.t. the metric topology). ⟧

p.244 **l.13 :** ⟦ ... the *attractor* of ... ⟧

p.255 **l.5 :** ⟦ ... the formula in 1. can be ... ⟧

p.260 **l.-8 :** replace "[Str84]" by ⟦ [Str87,BCS97] ⟧, where [BCS97] is Bürgisser, Peter; Clausen, Michael and Shokrollahi, M. Amin, Algebraic complexity theory, Springer, Berlin, 1997,

p.261 **l.-4 :** replace [Bra99b] by ⟦ [Bra03f] ⟧which is
Brattka, Vasco, The Emperor's New Recursiveness: The Epigraph of the Exponential Function in Two Models of Computability, Words, Languages & Combinatorics III, Ito, Masami and Imaoka, Teruo (eds), World Scientific Publishing, Singapore 2003, 63–72.

p.267 l.19 : ⟦ ... which corresponds to a given ⟧

p.277 l.24 : ⟦ $\delta_{\mathbb{B}}$, 52,66,84 ⟧

p.283 l.14 : replace "real RAM" by ⟦ real-RAM ⟧