

Corrections for the book CONVEX ANALYSIS AND OPTIMIZATION, Athena Scientific, 2003, by Dimitri P. Bertsekas

Last Modified: 5/25/11

- p. 3 (+22) Change “as the union of the closures of all line segments” to “as the closure of the union of all line segments”
- p. 37 (-2) Change “Every x ” to “Every $x \neq 0$ ”
- p. 38 (+1) Change “Every x in” to “Every $x \notin X$ that belongs to”
- p. 38 (+19) Change “i.e.,” to “with $x_1, \dots, x_m \in \mathfrak{R}^n$ and $m \geq 2$, i.e.,”
- p. 51 (-10) Change “since $x \in C$ and $y \in R_C$.” to “by our choice of x and y .”
- p. 63 (+4, +6, +7, +19) Change four times “ $c'\bar{y}$ ” to “ $a'\bar{y}$ ”
- p. 67 (+3 after the figure caption) Change “ $y \in AC$ ” to “ $\bar{y} \in AC$ ”
- p. 70 (+9) Change “[BeN02]” to “[NeB02]”
- p. 80 (+7) Change “ $C \cap M$ ” to “ $\text{cl}(C) \cap M$ ”
- p. 84 (+9) Change “ $x \in X$ ” to “ $x \in X \cap \text{dom}(f)$ ”
- p. 84 (-7) Change “that the set of minima of f over X ” to “that for a feasible problem, the set of minima of f over X ”
- p. 85 (-14) Change “Prop. 1.2.2(b)” to “Prop. 1.2.2(ii)”
- p. 85 (-10) Change “Prop. 1.2.2(c)” to “Prop. 1.2.2(iii)”
- p. 86 (-13) Change “ $x^* \in X$ ” to “ $x^* \in X \cap \text{dom}(f)$ ”
- p. 93 (+14) Change “ $x \in R_{V_\gamma}$ ” to “ $x \in V_\gamma$ ”
- p. 93 (-15) Change “ $(0, y) \in R_{\text{epi}(f)}$ ” to “ $(y, 0) \in R_{\text{epi}(f)}$ ”
- p. 110 (+3 after the figure caption) Change “... does not belong to the interior of C ” to “... does not belong to the interior of C and hence does not belong to the interior of $\text{cl}(C)$ [cf. Prop. 1.4.3(b)]”
- p. 116 (+16) Change “ $x = 0$ ” to “ $x - \bar{x} = 0$ ”
- p. 118 (+13) Change “proper” to “proper convex”
- p. 128 (+10) Change “Prop. 1.5.5” to “Prop. 1.5.4”
- p. 148 (-8) Change “ $\{x \mid r(x) \leq \gamma\}$ ” to “ $\{z \mid r(z) \leq \gamma\}$ ”
- p. 153 (-8) Part (a) Exercise 2.1 is trivial as stated and does not require the convexity assumption on f . Here is a corrected version and corresponding solution of part (a):

- (a) Consider a vector x^* such that f is convex over a sphere centered at x^* . Show that x^* is a local minimum of f if and only if it is a local minimum of f along every line passing through x^* [i.e., for all $d \in \mathfrak{R}^n$, the function $g : \mathfrak{R} \mapsto \mathfrak{R}$, defined by $g(\alpha) = f(x^* + \alpha d)$, has $\alpha^* = 0$ as its local minimum].

Solution: (a) If x^* is a local minimum of f , evidently it is also a local minimum of f along any line passing through x^* .

Conversely, let x^* be a local minimum of f along any line passing through x^* . Assume, to arrive at a contradiction, that x^* is not a local minimum of f and that we have $f(\bar{x}) < f(x^*)$ for some \bar{x} in the sphere centered at x^* within which f is assumed convex. Then, by convexity, for all $\alpha \in (0, 1)$,

$$f(\alpha x^* + (1 - \alpha)\bar{x}) \leq \alpha f(x^*) + (1 - \alpha)f(\bar{x}) < f(x^*),$$

so f decreases monotonically along the line segment connecting x^* and \bar{x} . This contradicts the hypothesis that x^* is a local minimum of f along any line passing through x^* .

p. 157 (-11 and -3) Change “nondecreasing” to “nonincreasing”

p. 213 (-6) Change “remaining vectors v_j , $j \neq i$.” to “vectors v_j with $v_j \neq v_i$, $j \neq i$.”

p. 219 (+3) Change “ $f_i : C \mapsto \mathfrak{R}$ ” to “ $f_i : \mathfrak{R}^n \mapsto \mathfrak{R}$ ”

p. 262 (+5) Change the equation to

$$g'(f(x); w) = \lim_{\alpha \downarrow 0, z \rightarrow w} \frac{g(f(x) + \alpha z) - g(f(x))}{\alpha}.$$

p. 265 (+10) Change “ $\bar{d}/\|\bar{d}\|$ ” to “ $-\bar{d}/\|\bar{d}\|$ ”

p. 268 (-3) Change “ $j \in A(x^*)$ ” to “ $j \notin A(x^*)$ ”

p. 338 (+16) Change “convex, possibly nonsmooth functions” to “smooth functions, and convex (possibly nonsmooth) functions”

p. 382 In Sections 6.5.3 and 6.5.4, a distinction is made between the interior and the relative interior of $\text{dom}(p)$. However, this distinction is valid only for the primal function of a problem with equality and inequality constraints. For a problem with inequality constraints only, the interior and the relative interior of $\text{dom}(p)$ coincide, since $\text{dom}(p)$ contains the positive orthant.

p. 384 (+6) Change “Section 5.2” to “Section 5.3”

p. 435 (-3) Change “... f_1 and $-f_2$ are proper and convex, ...” to “... f_1 and $-f_2$ are proper and convex, and $-f_2$ is also closed, ...”

p. 446 (+6 and +8) Interchange “... constrained problem (7.16)” and “... penalized problem (7.19)”

p. 458 (+13) Change “... as well real-valued” to “... as well as real-valued”

p. 458 (-10) Change “We will focus on this ... dual functions.” to “In this case, the dual problem can be solved using gradient-like algorithms for differentiable optimization (see e.g., Bertsekas [Ber99a]).”

p. 466 (+6) Change “ $y_i \subset \mathfrak{R}^m$ ” to “ $y_i \in \mathfrak{R}^m$ ”