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

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Some of these corrections were incorporated in the second printing of the book in April 2013

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 $x_1, \ldots, x_m \in \Re^n$ 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 "$c'\overline{y}$" to "$a'\overline{y}$"

p. 67 (+3 after the figure caption) Change "$y \in AC$" to "$\overline{y} \in AC$"

p. 70 (+9) Change "[BeN02]" to "[NeB02]"

p. 71 (-12) Change "$C \times \cdots \times C$" to "C"

p. 80 (+7) Change "$C \cap M$" to "$\mathrm{cl}(C) \cap M$"

p. 84 (+9) Change "$x \in X$" to "$x \in X \cap \mathrm{dom}(f)$"

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 "$x^* \in X \cap \mathrm{dom}(f)$"

p. 93 (+14) Change "$x \in R_{V_\gamma}$" to "$x \in V_\gamma$"

p. 93 (-15) Change "$(0, y) \in R_{\mathrm{epi}(f)}$" to "$(y, 0) \in R_{\mathrm{epi}(f)}$"

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 $\mathrm{cl}(C)$ [cf. Prop. 1.4.3(b)]"

p. 116 (+16) Change "$x = 0$" to "$x - \overline{x} = 0$"

p. 118 (+13) Change "proper" to "proper convex"

p. 128 (+10) Change "Prop. 1.5.5" to "Prop. 1.5.4"

p. 148 (+2) Change "with respect to x" to "with respect to z"

p. 148 (+4) Change "$(c+Mx-d-u)$" to "$(Mx-d-u)$"

p. 148 (-8) Change "$\{x \mid r(x) \leq \gamma\}$" to "$\{z \mid r(z) \leq \gamma\}$"

p. 150 (-15) Change "$\{x \mid t(x) \leq \gamma\}$" 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 $d \in \Re^n$, the function $g : \Re \mapsto \Re$, 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 $f(\overline{x}) < f(x^*)$ for some $\overline{x}$ in the sphere centered at x^* within which f is assumed convex. Then, by convexity, for all $\alpha \in (0,1)$,

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

so f decreases monotonically along the line segment connecting x^* and $\overline{x}$. 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. 174 (-10) Change "$b_j'x - \mu_{r+1}a_{r+1} \leq 0$" to "$b_j'x - \mu_{r+1}b_j'a_{r+1} \leq 0$"

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 "$f_i : C \mapsto \Re$" to "$f_i : \Re^n \mapsto \Re$"

p. 256 (+9) Change "$F_X(x)$" to "$F_X(x^*)$"

p. 262 (+5) Change the equation to

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

p. 265 (+10) Change "$\overline{d}/\|\overline{d}\|$" to "$-\overline{d}/\|\overline{d}\|$"

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

p. 274 (-14) Change "$a_j'x^* = 0$" to "$a_j'x^* = b_j$"

p. 274 (-10) 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 $\mathrm{dom}(p)$. 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 $\mathrm{dom}(p)$ coincide, since $\mathrm{dom}(p)$ contains the positive orthant.

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

p. 397 (+1) Change "from below by $\inf_{x \in X^k} g_j(x)$" to "from above by $\sup_{x \in X^k} g_j(x)$"

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. 461 In figure 8.1.2, the subgradient (-2,1) shown at the left of the figure is wrong. The correct subgradient is (-2,-1).

p. 466 (+6) Change "$y_i \subset \Re^m$" to "$y_i \in \Re^m$"