Errors in "Advanced Mathematical Economics"

by **Rakesh V. Vohra**

Chapter 2

- Page 25, Proof of Theorem 2.6: If we write the Farkas alternative (for the core equations) by directly following the definition in the book, it does not turn out to be what is in the proof. I think a little bit of tweaking to the Farkas alternative produces the desired result.
- Page 28: The given matrix looks wrong.

Chapter 3

- Page 35, Line -4: Set C' should be defined as follows: $C' = C \cap \{x \in \mathbb{R}^n : d(x,0) \leq d(y,0)\}$.
- Page 36, Line -8: The last inequality in the series of inequalities starting with $d(x^0,0)^2 \leq$ should be equality.

$$\begin{aligned} d(x^0,0)^2 &\leq ((1-\lambda)x^0 + \lambda x) \cdot ((1-\lambda)x^0 + \lambda x) \\ &= (x^0 + \lambda(x - x^0)) \cdot (x^0 + \lambda(x - x^0)) \\ &= d(x^0,0)^2 + 2\lambda x^0(x - x^0) + \lambda^2 d(x - x^0, 0)^2. \end{aligned}$$

- Page 38, Proof of Theorem 3.7, Line +11: This line should read $y^n = x^n - z^n \to x^* - z^* \ldots$ (not $x^* - y^*$).
- Both "half-space" and "half space" are used.

Chapter 4

- Page 55, Line -8: "point outs" should be "point out".
- Page 70: While writing Column player's optimization problem, you write $\max_x \left[\min_j \sum_{i=1}^m (a_{ij}x_i)\right]$. Similarly, while writing Row player's optimization problem it should be $\min_y \left[\max_i \sum_{j=1}^n (a_{ij}y_j)\right]$.
- Page 70, last line: The constraint for Column player is missing. Add s.t. $\sum_{i=1}^m x_i = 1, \quad x_i \geq 0 \ \forall \ i$.

- Page 71, Writing of Primal and Dual: In the min R part it should be $R - \sum_{j=1}^{n}(a_{ij}y_j) \geq 0$.
- Page 71, Line -11: It should read $\Pi(R) = \{x \in \mathbb{R}^m : \sum_i x_i = 1, x \geq 0\}$ - x_i is missing in the summation.
- Page 76, Proof of Theorem 4.19, Line +5: Matrix B is not defined before use.
- Page 76, Statement of Theorem 4.20: The two summations should be over the sets L and R respectively, not on $S \cap L$ and $S \cap R$ (though this is also technically correct).
- Page 78, Example 17: "multiply the first and third columns by -1", not the first and second columns.
- Page 79: Remove "s.t." while describing the polyhedron of the assignment problem.

Chapter 7

- Page 142, Example 26: The set containing four discrete points in the statement of the example is not a lattice. Figure 7.1 shows a different set of points. The set should be $\{(1,3),(4,3),(3,1),(1,1)\}$.
- Both $\max\{a,b\}$ and $\max(a,b)$ are used in the Chapter.
- Page 145, Statement of Theorem 7.7: We need X to be a lattice.
- Page 145, Definition 7.6: $(z_{-ij}, z'_i, z'_j), (z_{-ij}, z'_i, z_j)$, and (z_{ij}, z_i, z'_j) should be in X.
- Page 146, Line 1: It should be $i < k \leq j$ (you use $k \leq j$ in the next line).
- Page 148, Proof of Theorem 7.10, Lines -9 and -11: There is a misplaced ":" in both the lines before $\forall\ z \in X'$.
- Page 148, Proof of Theorem 7.10, Lines -14: It should read "It is easy to see that this is compact and ...".
- Page 149, Line -18: "Thus $x \succeq y$ if an only if ..." should be "Thus $x \succeq y$ if and only if ...".
- Page 150, Definition 7.13: You should state that $x, y \in X$ and at the end $x \vee y, x \wedge y \in X$.
- Page 153: The dual of the transportation problem looks incorrect. The dual constraints should be $\leq$, not $\geq$. This can be easily seen by taking $|S| = |D| = 1$ and $s_1 = d_1 = 1$. In that case, one can set $p_1 = 0$ and q_1 becomes unbounded.
- Page 153, Lemma 7.19: Looks wrong if the dual is wrongly written.

- Page 156, Line +4: The second equation of core should be $\sum_{j \in S} \mu_j + \mu_s \geq u(S \cup \{s\}) = V(S) \; \forall \; S \subseteq N$.

- Page 157, Lemma 7.25: This lemma is incorrect, i.e., the converse to Lemma 7.23 is not true. For instance, consider an example with two buyers and two goods with valuations: $v_{11} = 8, v_{12} = 4;\; v_{21} = 6, v_{22} = 3$. The core point that gives zero payoff to both buyers and a revenue of 11 to the seller is not achievable in any Walrasian equilibrium. This can be verified by observing that the maximum Walrasian equilibrium price vector is $(7, 3)$ where buyer 1 gets a payoff of 1. In the wake of this, a Theorem connecting the minimum Walrasian equilibrium price vector and the VCG payments is needed.

Chapter 8

- Page 164, Line +17: The term "graphic matroid" is used without any definition. Earlier reference was to "forest matroid".

- Page 164, Proof of Lemma 8.6, Line -11: The line should read "... such that $T \backslash \{j\} \notin \mathcal{I}$". $T \setminus \{j\}$ does not belong to $\mathcal{I}$.

- Page 165, Proof of Theorem 8.9, Line +20: e should belong to $B \setminus B'$. If $e \in B' \setminus B$, as is stated in the book, then $B' \cup \{e\}$ does not make any sense.

- Page 165, Greedy algorithm: Better to use e_t to denote the t^{th} element and w_{e_t} as its weight.

- Page 166, Line +11: "The greedy algorithm computes a maximum weight basis for a matroid" - Is this true? What if all elements have negative weights?

- Page 166, Line -13: Should not $\{e_1, \ldots, e_{k-1}, q_1, \ldots, q_k\}$ be $\{e_1, \ldots, e_{k-1}\} \cup \{q_1, \ldots, q_k\}$?

- Page 166, Line -10: $\mathcal{I}$ should include $\{1, 3\}$ instead of $\{1, 2\}$.

- Page 169, Definition 8.18: A reference should be made to a set whose bases are B and $E \setminus B$.