LIST OF ERRATA

Routing, Flow, and Capacity Design in Communication and Computer Networks

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CHAPTER 3
Pages 85 and 86
The model discussed in Section 3.4 should be adjusted in the following way:
We should consider demand volume h_d to be in Mbps and accordingly change the capacity constraint to

$$\sum_d h_d \sum_p \delta_{edp} u_{dp} \le M y_e, \quad e = 1, 2, ..., E,$$

where M is the capacity unit of an ATM link, say $M = 155$ Mbps. Thus, y_e means the number of such module units required on link e. Now, let ξ_e be the unit cost of a one 155 Mbps module M on link e. Then, model (3.3.2) would change to:

$$\begin{array}{lll} \textbf{\textit{minimize}}_{\ \boldsymbol{u},\boldsymbol{y}} & \boldsymbol{F} = \sum_e \xi_e y_e & \\ \textbf{\textit{subject to}} & \sum_p u_{dp} = 1, & d = 1, 2, ..., D \\ & \sum_d h_d \sum_p \delta_{edp} u_{dp} \le M y_e, & e = 1, 2, ..., E \\ & u_{dp} \text{ binary, } y_e \text{ integers.} & \end{array}$$

CHAPTER 4
Page 117 ***formula (4.2.2c)***
should read: $\sum_p \delta_{edp} x_{dp} \le h_d / n_d, \quad e = 1, 2, ..., E \quad d = 1, 2, ..., D.$
instead of: $\delta_{edp} x_{dp} \le h_d / n_d, \quad e = 1, 2, ..., E \quad d = 1, 2, ..., D \quad p = 1, 2, ..., P_d$

Page 118 ***lines 17-18 from the bottom***
delete the following:
; this constraint is redundant (and can be removed) as it is implied by (4.2.3a)

Page 138 ***formula (4.3.24a)***
should read: minimize $\boldsymbol{F} = \sum_e \xi_e \sum_k (a_{ek} y_{ek} + b_{ek} u_{ek})$
instead of: minimize $\boldsymbol{F} = \sum_e \sum_k (a_{ek} y_{ek} + b_{ek} u_{ek})$

Page 149 ***lines 14-16 from the top***
should read:
Show that the property $f(z_1)/z_1 \ge f(z_2)/z_2$ for $z_1 < z_2$ holds for non-decreasing concave functions, and that the property $f(z_1)/z_1 \le f(z_2)/z_2$ for $z_1 < z_2$ holds for non-decreasing convex functions (in both cases we assume $f(0) = 0$).
instead of:
Show that the property $f(z_1)/z_2 \ge f(z_2)/z_2$ for $z_1 < z_2$ holds for non-decreasing concave functions, and that the property $f(z_1)/z_2 \le f(z_2)/z_2$ for $z_1 < z_2$ holds for non-decreasing convex functions.

CHAPTER 5
Page 163 ***line 12 from the top***
should read: lution $\boldsymbol{x}$ and z of the subproblem ... *instead of*: lution z^* of the subproblem ...

Page 163 ***lines 6-9 from the bottom***
delete the following two sentences:
In particular it may be important to provide the BB procedure with direct means for omitting the combinations of binary variables leading to unfeasible relaxed subproblems. This is important for instance when binary variables are subject to the single-path routing constraint, e.g., see (4.2.5a).

Page 165 ***lines 7-8 from the bottom***
should read:
BBI$((\Omega\backslash\{d_i(\Omega) \leq x_i \leq g_i(\Omega)\}) \cup \{d_i(\Omega) \leq x_i \leq \lfloor x_i'(\Omega)\rfloor\});$
BBI$((\Omega\backslash\{d_i(\Omega) \leq x_i \leq g_i(\Omega)\}) \cup \{\lceil x_i'(\Omega)\rceil \leq x_i \leq g_i(\Omega)\})$
instead of:
BBI$((\Omega\backslash\{d_i(\Omega) \leq x_j \leq g_i(\Omega)\}) \cup \{d_i(\Omega) \leq x_j \leq \lfloor x_j'(\Omega)\rfloor\});$
BBI$((\Omega\backslash\{d_i(\Omega) \leq x_j \leq g_i(\Omega)\}) \cup \{\lceil x_j'(\Omega)\rceil \leq x_j \leq g_i(\Omega)\})$

Page 168 ***line 5 from the bottom***
should read:
$\mathcal{NP}$-complete (see Appendix B) with respect to the problem size $O(n \log W)$, although it can be solved in time $O(nW)$ as demonstrated below. (The knapsack problem can be solved in the so called *pseudo-polynomial* time, because if nW is bounded by a polynomial with a fixed degree then the DP algorithm based on formula (5.2.7) is also polynomial; for a discussion of the notion of pseudo-polynomial algorithms and *strong* $\mathcal{NP}$*-completeness* see [GJ79], Section 4.2 and p.247.)
instead of:
$\mathcal{NP}$-complete ([GJ79]) with respect to the problem size $n + W$.

Page 168 ***formula (5.2.7)***
should read: $\boldsymbol{F}^*(k, w) = max\ \{\boldsymbol{F}^*(k-1, w), \boldsymbol{F}^*(k-1, w-w_k) + r_k\}.$
instead of: $\boldsymbol{F}^*(k, w) = max\ \{\boldsymbol{F}^*(k-1, w), \boldsymbol{F}^*(k-1, W-w_i) + r_i\}.$

Page 169 ***lines 1-3 from the top***
should read:
Assuming initial values $\boldsymbol{F}^*(0, w) = 0$ for all $w \geq 0$ and $\boldsymbol{F}^*(k, w) = -\infty$ for all k when $w < 0$, we may compute consecutive values of $\boldsymbol{F}^*(k, w)$, starting from $\boldsymbol{F}^*(1, 1)$, until we reach $\boldsymbol{F}^*(n, W)$. Exercise 5.7 asks the reader to write down ...
instead of:
Assuming initial values $\boldsymbol{F}^*(k, w) = 0$ for all $w \geq 0$ and $\boldsymbol{F}^*(k, w) = -\infty$ for all k when $w < 0$, we may compute consecutive values of $\boldsymbol{F}^*(k, w)$, starting from $\boldsymbol{F}^*(1, 1)$, until we reach $\boldsymbol{F}^*(N, W)$. Exercise 5.7 asks the reader is write down ...

Page 176 ***formula (5.3.11)***
should read: $q(|\boldsymbol{x}|) = q_0 > \frac{1}{2}$ for $0 < |\boldsymbol{x}| < H$ *instead of*: $q(|\boldsymbol{x}|) = q_0 \geq \frac{1}{2}$ for $0 < |\boldsymbol{x}| < H$

Page 176 ***formula (5.3.12)***
should read: $(H - |\boldsymbol{x}|)/(2q_0 - 1).$ *instead of*: $(H - |\boldsymbol{x}|)/(2q_0 - \frac{1}{2}).$

Page 186 ***formula (5.4.13e)***
should read: $\sum_e \delta_{edp}\pi_e^* > \lambda_d^*$ implies $x_{dp}^* = 0, \quad d = 1, 2, ..., D \quad p = 1, 2, ..., P_d$
instead of: $\sum_e \delta_{edp}\pi_e^* < \lambda_d^*$ implies $x_{dp}^* = 0, \quad d = 1, 2, ..., D \quad p = 1, 2, ..., P_d$

Page 206 lines 22 and 23 from the top
should read:
leads to a class of difficult NDPs; such problems are sometimes used as benchmarks for testing efficiency of the MIP solvers in finding exact MIP solutions (see [CDPP02]). Later, in Sections 11.1.4 and 11.1.5, we will explain how a LR-based dual approach can be used to solve such problems approximately
instead of:
leads to a class of difficult dimensioning problems; later in Sections 11.1.4 and 11.1.5 we will explain that a LR-based dual approach can be used to solve such problems effectively

CHAPTER 6

Page 215 Algorithm 6.1
Determination of I_j in Step 1 should be done as follows:
Let $L_j = \{i : \xi_{ij} - \xi'_i < 0\}$. If $|L_j| \le K_j$ set $I_j = L_j$. Otherwise, if $|L_j| > K_j$, set $I_j = \underline{L}_j$, where $\underline{L}_j \subset L_j, |\underline{L}_j| = K_j, \forall\, \ell \in \underline{L}_j\ \forall\, m \in L_j \setminus \underline{L}_j,\ \xi_{\ell j} - \xi'_\ell \le \xi_{mj} - \xi'_m$.

Page 245 line 14 from the bottom
should read: problem is $\mathcal{NP}$-complete itself (although solvable in pseudo-polynomial time, see Section 5.2.4), its relaxation can be used as proposed in [DF79]:
instead of: problem is $\mathcal{NP}$-complete itself [GJ79], its relaxation can be used as proposed in [DF79]:

Page 245 line 13 from the bottom
should read: ***maximize*** ... *instead of*: ***minimize*** ...

Page 246 lines 1-2 from the bottom
should read: (continuous) *instead of*: (binary)

Page 248 line 13 from the bottom
should read: normalized continuous flows x_{dp}. *instead of*: binary variables u_{dp}.

Page 248 formulation (6.4.15)
should read:
minimize $\boldsymbol{F} = \sum_e \xi_e (\sum_d \sum_p \delta_{edp} h_d x_{dp}) + \sum_e \kappa_e u_e + \sum_v \varphi_v s_v$
subject to (6.4.10b), (6.4.10d-e) and
$\sum_p x_{dp} = 1, \quad d = 1, 2, ..., D$
$\sum_d \sum_p \delta_{edp} x_{dp} \le M_e u_e, \quad e = 1, 2, ..., E.$
instead of:
minimize $\boldsymbol{F} = \sum_e \sum_d \sum_p \xi_e \delta_{edp} u_{dp} h_d + \sum_e \kappa_e u_e + \sum_v \varphi_v s_v$
subject to (6.4.10b), (6.4.10d-e) and
$\sum_d u_{dp} = 1, \quad d = 1, 2, ..., D$
$\sum_d \sum_p \delta_{edp} u_{dp} h_d \le M_e u_e, \quad e = 1, 2, ..., E.$

Page 248 formulation (6.4.16)
should read:
minimize $\boldsymbol{F} = \sum_d \sum_p (\sum_e \zeta_{ed} \delta_{edp}) x_{dp}$
subject to $\sum_p x_{dp} = 1, \quad d = 1, 2, ..., D$

instead of:

minimize $\boldsymbol{F} = \sum_d \sum_p (\sum_e \zeta_{ed} \delta_{edp}) u_{dp} h_d$

subject to $\sum_d u_{dp} = 1, \quad d = 1, 2, ..., D$

$\sum_d \sum_p \delta_{edp} u_{dp} h_d \le M_e u_e, \quad e = 1, 2, ..., E.$

CHAPTER 7

Pages 267, 267, and 277

Problems (7.2.1) and (7.4.2) need the following clarification:

In the case of integral positive weights it is always the case that if two paths have different lengths, then these lengths differ by at least 1. In the case of continuous weights ($w_e \ge 1$), for any feasible solution $\boldsymbol{w}$ we can form another feasible solution $\boldsymbol{w}'$ of the form $\boldsymbol{w}' = \alpha \boldsymbol{w}$ such that any two paths $\mathcal{P}_1$ and $\mathcal{P}_2$ have the same same length with respect to $\boldsymbol{w}$ if, and only if, $\mathcal{P}_1$ and $\mathcal{P}_2$ have the same length with respect to $\boldsymbol{w}'$. Moreover, if two paths $\mathcal{P}_1$ and $\mathcal{P}_2$ have different lengths for $\boldsymbol{w}$, then their lengths differ by at least 1 for $\boldsymbol{w}'$ (we just need to choose a sufficiently large scalar $\alpha > 1$). We use this property in (7.2.1g) and in (7.4.2a).

Page 282 line 13 from the top

should read: ... LP problem is infeasible. *instead of*: ... LP problem is feasible.

Page 302 Figure 7.12 legend

there should be minus signs in front of: $2 \ln(1-\rho)$, $1.5 \ln(1-\rho)$, $\ln(1-\rho)$.

CHAPTER 8

Page 345 formula (8.3.42a)

should read: $F(\boldsymbol{x}^*) = \frac{(\sum_d \sqrt{w_d \zeta_d}\,)^2}{B}$ *instead of*: $F(\boldsymbol{x}^*) = \frac{(\sum_d \sqrt{\sum_d w_d \zeta_d}\,)^2}{B}$

Page 345 formula (8.3.42b)

should read: $x_d^* = \frac{B\sqrt{\frac{w_d}{\zeta_d}}}{\sum_d \sqrt{w_d \zeta_d}}$ *instead of*: $x_d^* = \frac{B\sqrt{\frac{w_d}{\zeta_d}}}{\sum_d \sqrt{\sum_d w_d \zeta_d}}$

CHAPTER 9

Page 387 formula (9.5.1c)

should read: $\sum_q \beta_{\ell eq} c_e u_{eq} \le y_\ell$ *instead of*: $\sum_q j \beta_{\ell eq} u_{eq} c_e \le y_\ell$

CHAPTER 11

Page 467 line 5 from the top

should read: $\frac{\partial W(\boldsymbol{\pi})}{\partial \pi_{et}^k}\Big|_{\boldsymbol{\pi}=\boldsymbol{\pi}^k} = \sum_d \sum_i h_{dti} \delta_{ed\hat{p}_k ti} - M \hat{y}_e^k, \quad e = 1, 2, ..., E \quad t = 1, 2, ..., T.$

instead of: $\frac{\partial W(\boldsymbol{\pi})}{\partial \pi_{et}^k}\Big| \boldsymbol{\pi} = \boldsymbol{\pi}^k = \sum_d \sum_i h_{dti} \delta_{ed\hat{p}_k ti} - M \hat{y}_e^k, \quad e = 1, 2, ..., E \quad t = 1, 2, ..., T.$

Page 470 Table 11.5: (first column header)

should read: **Network** *instead of*: **3-9**

Page 471 line 9 from the top

should read: $\zeta_{dt\breve{\imath}p}(\boldsymbol{\pi}^k) = \zeta_{dt\tilde{\imath}p}(\boldsymbol{\pi}^k)$ for $\breve{\imath} \ne \tilde{\imath}$. *instead of*: $\zeta_{dt\breve{\imath}p}(\boldsymbol{\pi}^k) = \zeta_{dt\tilde{\imath}p}(\boldsymbol{\pi}^k)$ for $\breve{\imath} \neg \tilde{\imath}$.

CHAPTER 13

Page 585 ***Proposition 13.1***

It should be stated that formula (13.1.7) follows directly from the complementary slackness property of convex programming problems (see Section A.7).

APPENDIX A

Page 616 ***formula (A.3.2), second line***

should read: $\frac{\partial f(\boldsymbol{\delta},\boldsymbol{\varepsilon})}{\partial \varepsilon_j} = -\lambda_j \quad j = 1, 2, \ldots, m.$ *instead of*: $\frac{\partial f(\boldsymbol{\delta},\boldsymbol{\varepsilon})}{\partial \varepsilon_j} = -\lambda_j \quad i = 1, 2, \ldots, k.$

Page 617 ***line 1 from the top***

should read: steepest descent of function $F(\boldsymbol{x})$ at point $\boldsymbol{x}'$.
instead of: steepest descent of function $F(\boldsymbol{x})$ at point $\boldsymbol{x}$

Page 617 ***line 3 from the top***

should read:
(i.e., the right derivative $f'(0^+)$ of the one-variable function $f(\alpha) = F(\boldsymbol{x}' + \alpha\boldsymbol{d})$) is equal to
instead of:
(i.e., the right derivative $f'(0^+)$ of the one-variable function $f(\alpha) = F(\boldsymbol{x} + \alpha\boldsymbol{d})$) is equal to

Page 618 ***formula (A.5.5)***

It should be added that inequality (A.5.5) holds also for all feasible solutions $\boldsymbol{x}$ of (P) and for all $(\boldsymbol{\lambda}, \boldsymbol{\mu})$ such that $\boldsymbol{\lambda} \geq \mathbf{0}$.

Page 622 ***line 12 from the top***

should read: $\boldsymbol{y}^i$ we have $\boldsymbol{s} \in \partial w(\boldsymbol{y}^i)$, $y_l^i = 0$, and $s_l < 0$, then we have to set s_l to 0, in order to make
instead of: $\boldsymbol{y}^i$ we have $\boldsymbol{s} \in \partial w(\boldsymbol{y})$, $y_l^i = 0$, and $s_l < 0$, then we have to set s_l to 0, in order to make

APPENDIX D

Page 655 ***line 28 from the top***

should read: ... in Maple is allowed. However, unlike Maple, ...
instead of: ... in Matlab is allowed. However, unlike Matlab, ...