Formal Models of Computation

Errata

Chapter 0

• page 3 — the third line of the last paragraph should read: Russell's paradox that is stated as follows: let $r$ denote the set of all those.

• page 6 — the second line in the fourth paragraph should read: operation, written $p(S)$, that is the collection of all subsets of $S$, $p(S) = \{T \mid T \subseteq S\}$

Chapter 1

• page 57 — the equation in line 4 has an extra nested parenthesis, it should read:

$E'(s, r_1) = \text{closure}(\{t \mid r \	ext{ closure}(s) \text{ with } t \in r_1\})$ (thanks to Jie Peng).

• page 63 — the last paragraph of Example 1.3.1 should refer to Exercise 1.45.

• page 63 — the second line of Theorem 1.3.2 should refer to Theorem 1.2.4 and 1.2.2 (thanks to Jie Peng)

• page 65 — the equation in line 1 should read:

$d(t, l) = d_2(t, l)$ for all …

• page 86 — problem 1.32 should refer to the previous problem, 1.31.

Chapter 2

• page 91 — the third line of Theorem 2.1.1 should read: $z \in L$ with $\text{len}(z) \geq N$ … (thanks to Wei Jiang).

• page 92 — the third line below Figure 2.1.1 should read: $\text{len}(v) \geq 1$ … (thanks to Wei Jiang).

• page 114 — the first line of the second paragraph should read: Conversely, if $\text{val}(x) \mod 3 \neq \text{val}(y) \mod 3$ … (thanks to Jie Peng).

• page 128 — problem 2.1(g) should read: $L_g = \{x \in \Sigma^* \mid \text{w,y,z} \in \Sigma^+ \text{ so } x=wy \text{ and } x=zv\}$ (thanks to Eduard Dragut).

Chapter 3

• page 148 — line 2 should read: integer $k \geq 0$ …

• page 149 — the third line before the end of Example 3.2.1 should read: from the same state $(s_2)$ … (thanks to Wei Jiang).

• page 183 — in problem number 3.22, the two parenthetical references to $n$ should read: $(n \geq 1)$. 
Chapter 4

• page 192 — add the following sentence to the end of Definition 4.1.4: A language $L$ is context-free if there exists a context-free grammar $G$ so that $L = L(G)$ (thanks to Kevin Lillis).

• page 201 — the last line should read: derivation $A \xrightarrow{a} b_1 b_2 \ldots b_k \xrightarrow{w} \ldots$

• page 214 — the next to last line should read: obtaining (since both $A \xrightarrow{a} B$ and $A \xrightarrow{a} C$) (thanks to Eduard Dragut).

• page 215 — the first line should read: Then we replace $B \xrightarrow{a} C$ obtaining (since only $B \xrightarrow{a} C$) … (thanks to Eduard Dragut).

• page 220 — the first line of the proof of Theorem 4.4.4 should read: For $G = (V, \Sigma, P, S)$, by Lemma 4.4.3 … (thanks to Nitin Chopra).

• page 228 — the last line of paragraph should read: production $<\text{term}> \xrightarrow{a} <\text{factor}>$ (thanks to Eduard Dragut).

• page 238 — the last line should read: $A \xrightarrow{a} \Sigma \wedge V$ will determine the set $V_A = \{Z \in V | A \xrightarrow{a} Z\}$.

Chapter 5

• page 250 — in the middle of the proof of Theorem 5.1.1, item (iii) should read: (iii) $d'(s, s, Y) = d(s, s, Y) \xrightarrow{a} \{e, e\} \ldots$ (thanks to Kevin Lillis).

• page 260 — the next to last line of Example 5.2.3 should read: $<0, a, 0>$ is a dead symbol) … (thanks to Xiaoding Luo).

• page 267 — add $\square$ at the bottom of the page to signify the end of the proof of Lemma 5.3.2.

• page 270 — in the table at the bottom of the page, the entry in row $s_3$, column $(a,B)$ should be $s_4/A$, and this cell should be shaded (thanks to Jian Jia and Qingchuan Zang).

• page 277 — in problem 5.6(h), the language should read: $\{x_1 x_2 \ldots x_p c^p \mid p \geq 1 \text{ and } x_i \in \{a^k, b^k \mid k \geq 1\}, 1 \leq i \leq p\}$ (thanks to Mah-Lih Chen).
Chapter 6

• page 283 — The first line of the proof of Theorem 6.1.1 should read: Suppose that we have context-free languages $L_1, L_2 \subseteq \mathbb{L}^*$. … (thanks to Nitin Chopra).

• page 284 — in the proof of Theorem 6.1.2, the transition function $d$ of PDA $A'$ should be defined as follows: for each $a \in \Sigma$ and $Y \in G$, $(<p',q'>,\epsilon) \in \delta(p,q,a,Y)$ if and only if $(p',a) \in \delta_A(p,a,Y)$ and $q' \in \delta_B(q,a)$ (thanks to Min Shi).

• page 297 — The first line of case 2 should read: Since $\text{len}(vx) \leq n$, in this case $x \subseteq a*b*$. … (thanks to Nitin Chopra).

• page 297 — The first line of case 3 should read: In this case $x \subseteq b*c*$, Then … (thanks to Nitin Chopra).

• page 305 — The program fragment in Figure 6.3.1 is missing a closing $\textbf{end}$ at the end (thanks to Eduard Dragut).

• page 336 — Exercise 6.4 should refer to exercise 2.16 (thanks to Eduard Dragut).

• page 336 — Exercise 6.5 should refer to exercise 2.17 (thanks to Eduard Dragut).

Chapter 7

• page 349 — the third line of Example 7.1.2 should refer to Theorem 7.1.2 (thanks to Nitin Chopra).

• page 350 — In Example 7.1.3, in the second line of sample derivation (2), delete the repeated occurrence of $a^3b^2CCBC$ (thanks to Eduard Dragut).

• page 353 — the third line of the proof of Theorem 7.1.3 should read: grammar $G' = (V, \mathbb{L}, P, S)$ … (thanks to Nitin Chopra).

• page 353 — the second line of the second paragraph of the proof of Theorem 7.1.3 should refer to Theorem 7.1.2 (thanks to Nitin Chopra).

• page 369 — Definition 7.2.6 should read: if $G = (V, \mathbb{L}, P, S)$ … (thanks to Jie Peng).

• page 377 — The proof of Theorem 7.3.1 should refer to exercises 7.10 and 7.11, not 7.6 and 7.7.

Chapter 8

• page 424 — in Definition 8.3.3, the third bullet should read:
  
  • $k<1$ or $k>h$, and $\bar{i}_j = \bar{i}_i$ for all $j \geq i$ — …

• page 424 — in Definition 8.3.4, the last line should end with: … with an ID $<h, f(x_1, x_2, \ldots, x_n), \ldots>$. 
• page 429 — the first line of the proof of Theorem 8.4.1 should refer to Theorem 7.2.2 (thanks to Jie Peng).
• page 429 — the first sentence of the second paragraph of the proof of Theorem 8.4.1 should read: Let \( T = (S, \{\}, \{\}, s_0, B, R) \) … (thanks to Eduard Dragut).
• page 431 — the first line of the proof of Theorem 8.4.2 should refer to Theorem 7.2.3.
• page 431 — the first sentence of the second paragraph of the proof of Theorem 8.4.2 should read: Given a phrase structure grammar \( G = (V, \{\}, P, S) \), the strategy is to (thanks to Eduard Dragut).
• page 431 — the first line of the third bullet in the proof of Theorem 8.4.2 should read: if not, find all strings \( d_{k_1+1}, d_{k_1+2}, \ldots, d_{k_2} \) derivable from some \( d_i, 2 \leq i \).
• page 435 — line eight should read: \( a_{k+1}ba_{k-1} \ldots a_2a_1\# \ldots \)
• page 437 — in the third line replace compliment by complement (thanks to Eduard Dragut).
• page 437 — the second line of the last paragraph should read: recognizable, then neither …
• page 438 — Definition 8.4.1 should refer to Theorem 8.4.7 (thanks to Eduard Dragut).
• page 438 — Definition 8.4.2 should begin: for \( \emptyset = \{0,1\} \) … (thanks to Jie Peng).
• page 439 — the beginning of the second line of the third paragraph should read: \( \emptyset(s_1,1) = <s_2,0,R> \ldots \)
• page 439 — in the third paragraph on this page the description of the Turing machine recognizing the language \( 1(0+1)^* \) should be: \( 111010010010100111 \); propagate this change throughout the paragraph (thanks to Paula Kelly).
• page 447 — in Problem 8.19, part (b) should be marked as having a solution, not part (a) (thanks to Jie Peng).

Chapter 9

• page 452 — in Figure 9.1.2, the label for the leftmost symbol should read: starting square of \( U \).
• page 461 — the first line should read: or not we even have something we should refer to as a “language.
• page 489 — in problem 9.27, the definition for ‘useful’ should require \( \emptyset, \emptyset (V \emptyset) \) (thanks to Kevin Lillis).
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• page 470 — in the second paragraph, third line form the end should have: T=(S,S,S,G,d,0,B,R) (thanks to Eduard Dragut).

• page 476 — the fifth line of the proof of Corollary 9.3.5 should read: {e} and L(G_2) – {e} … (thanks to Eduard Dragut).

Appendix: Sample Solutions

• page 491 — in the solution for problem 1.3(e), the regular expression for all sequences with an even number of ‘1’s should be 0*(1 0*1 0*)*, and the regular expression for all sequences with an odd number of ‘1’s should be 0*(1 0*1 0*)* 1 0*; an alternate solution for an odd number of ‘1’s is (0 + 1 0*1)* 1 0* (thanks to Kevin Lillis).

• page 512 — the solution to Problem 7.2(b) should read: This string is derived by S aSA aaaBA aabBc a 2 b 2 c 2 (thanks to Eduard Dragut).

• page 512 — the first line of the second paragraph of the solution for Problem 7.4(f) should read: So by the context-free rules, S^* 0^nSX^n … (thanks to Jie Peng).

• page 519 — Problem 8.19(a) is actually a solution for Problem 8.19(b) (thanks to Jie Peng).

• page 521 — The last paragraph of the solution for Problem 9.16 should read as follows. This occurs if and only if A yB and A y'C, where y = y'w for w in *. Then z' = wz, B z, and C z'. So check all such production pairs (finitely many) to see if w L(B) L(C) ≠ ∅ (thanks to Jie Peng).