Corrigenda and addenda for "Non-Uniform Random Variate Generation" by Luc Devroye, Springer-Verlag, 1986

2 Line 7: are...

7 In the table on page 7, we need some parentheses around the (b/x) for the Pareto c.d.f.. Pointed out by Steve Marron.

29 In the table, row 3 (Rayleigh disttribution): a "2" is missing twice in front of the logs in columns 3 and 4. Pointed out by Jonathan Wagner.

33–35 The algorithm given on page 33 is regula falsi, not the secant method. In the secant method (Ostrowski, 1973, p. 31), one proceeds from successive adjacent points, and thus, new points could fall outside the original interval. On page 35, the discussion involving the golden ratio apoplies to the secant method, under conditions. The regula falsi, on the other hand, has slower convergence rates comparable to bisection. This error was pointed out by Richard Simard from the University of Montreal.

39 Replace "extremal value" twice by "extreme value", to be consistent with the index.

47 In the first algorithm, replace $\psi(x)$ by $\psi(X)$.

49 Line 1: Devroye (1986).

55 Line -4: "Example 3.2" should read "Section 3.2".

62 Error pointed out by Wojcieh Niemiro of the University of Warsaw: Sibuya's algorithm described on page 62 is wrong. Hence, remove everything starting at "Show the following:" up to the end of the exercise. Replace it with the following text: **A.** Let g be uniform on $[0,1]$, and let f be a fifty–fifty mixture of a uniform $[0,1]$ and a uniform $[1/2,1]$ density (so that $c = 3/2$). Show that Sibuya's algorithm is incorrect by deriving the density of the generated random variate X. **B.** If $\sup(cg(x)/f(x)) > 1$, show that with positive probability, the algorithm does not halt.

64 UNTIL $Y \leq 1$ moves down one line.

83 Point D: delete one period following "Indirectly".

127-129 Monahan's 1979 paper is full of errors. The following changes are required: on page 127, in the definition of $H(x)$, replace a_n by a_n/n. The last line of Theorem 2.2 should read to have an expected number of random variates with distribution function G equal to $(1+\int_0^1 H)/[-H(-1)]$. On page 128, line 6, the rhs should read $(a_{n+1}G(x)^{n+1})/(n+1)$, and on line 7, the rhs should read $(a_{n+1}G(x)^{n+1})/(n+1) - (a_{n+2}G(x)^{n+2})/(n+2)$. On lines 9 and 11, replace a_n by a_n/n. On line 9, insert

"-" in front of $H(-1)$. Replace the computations on lines 13 through 16 by

$$\begin{aligned}
\mathbb{E}N &= p_0^{-1} \sum_{n=1}^{\infty} (n+1) \mathbb{P}(A_{n-1} A_n^c) \\
&= p_0^{-1} \sum_{n=1}^{\infty} (n+1)(\frac{a_n}{n} - \frac{a_{n+1}}{n+1}) \\
&= p_0^{-1} (1 + \sum_{n=1}^{\infty} \frac{a_n}{n(n+1)}) \\
&= p_0^{-1} (1 + \int_0^1 H(x) dx).
\end{aligned}$$

On page 129, on line 8, add that $a_n = (\pi/2)^{2n-2}/(2n-1)!$, and on line 10, replace $2n+2$ by $2n$. In the algorithm, replace $4K^2 + 6K + 2$ by $4K^2 + 2K$. On line 3, replace $H(-1)$ by $-H(-1)$, and remove the part "while $\cdots$ 2.74.". The Monahan errors were pointed out by Uli Dieter.

133 Exercise 1: replace $\mathbb{E}N = e/(e-1)$ by $\mathbb{E}N = e^2/(e-1)$.

145 Line -11: "point in case" should read "case in point".

164 Replace $Q \leq P^{n^2-1}$ by $Q \leftarrow P^{n^2-1}$. Found by Boris Shukhman.

170 Replace THEN W line by "THEN $W \leftarrow U - 1$". Replace ELSE W line by "ELSE $W \leftarrow (2U)/(eX^2) - 1$".

175 Line 9: state that S is the sign of V.

179 Last line of Theorem 6.5: u^2 instead of u.

182 First line: right-hand side should be ae^{-ax} rather than just e^{-ax}. Pointed out by Russell Davidson.

188 Example 6.7: in line 2, e^{-s} should be e^{-s^α}.

198 $\leq x - x^2/2 + x^3/3 \leq$ should be $\leq \min(x - x^2/2 + x^3/3, x)$.

200 In table 7.2, the range $x \in \mathbb{R}$ should be $x > 0$. Pointed out by Zhemning Su (Univ. of Alaska Fairbanks).

201 a - definition: - sign omitted. Rejection constant: closing parenthesis of $\Gamma(a/2)$ is misplaced.

204 Exercise 5: $\cdots$ for which the region A is unbounded. Omit "in the v-direction, i.e. $b = \infty$".

223 Last line of algorithm: $(U_{(2)} - U_{(1)})$:) missing.

232 Line 1: fix to read $\Gamma(\frac{d}{2} + 1)$.

237 In both cases, we $\cdots$: replace by "We...".

244 Exercise 19: write $SX^{1/p}$ instead of $X^{1/p}$, and mention that S is a random sign.

251 Line -8: $F(x)$ shoud be replaced by $1 - F(x)$. (Wolfgang Hoerrmann).

252 Line 7: $T+$ has to be erased. Similarly, $T+$ should also be deleted on lines 12 (twice) and 16 (once). (Wolfgang Hoerrmann and Troels Pedersen).

304 In the algorithm, replace $|X|$ by X, twice. Not an error, just a redundancy. Pointed out by Boris Shukhman.

306 Algorithm B2PE. $a < 2$ should be $a \leq 2$, and $b < 2$ should be $b \leq 2$. Pointed out by Chi-Tak. Also, on line -2, replace "left" twice by "right". Note that Schmeiser and Babu have a and b instead of $a - 1$ and $b - 1$ in the definition of λ; they may be wrong.

307 In line -5 of algorithm, replace "if $T > -2\ldots$" by "if $T < -2\ldots$", and add "and if $X \in (0, 1)$" at end of same line. Pointed out by Boris Shukhman.

312-313 Add "on $(0, \infty)$" after "convex" on line -8.

318 Line -1: replace log-concave by concave. Pointed out by Wolfgang Hörmann.

326 In the table, change $1/\sqrt{2E}$ to $\sqrt{2E}$ in the column next to "Laplace". Add an entry for symmetric gamma densities with parameter a, showing that the mixing variable should be $\sqrt{2G_a}$, where G_a is gamma (a).

327 Misprints in Theorem 3.6: $a \geq -1$ should be $a > -1$. Also, closing parenthesis misplaced in the definition of μ_a.

368-370 In section 3.2, we should restrict the attention to **nice** compact sets, where a set A is called nice when the indicator function I_A is Riemann integrable. In particular, Theorem 3.1 is false as stated, but is correct for nice compact sets of nonzero Lebesgue measure. The proof should be omitted and replaced by a one-liner recalling the definition of Riemann integrability. Add a note stating that most sets occurring in "natural" applications are nice. Pointed out by Niederreiter.

373-374 Lots of problems in the car-parking problem.

385 In (iii): ")" missing following $(1 - \frac{x^2}{2})$.

410 Best's algorithm XG: use it only for $a > 1$; for $a = 1$ simply return an exponential random variate. Pointed out by Jeff Miller (Otago, New Zealand) after he noticed that X/b created a division by zero problem for $b = a - 1 = 0$. One could use the fact that $b \log(X/b) = 0$ for $b = 0$ and work this in, but this is not elegant.

413 Cheng's algorithm GB: in the set-up, add $\lambda \leftarrow \sqrt{2a - 1}$. In the definitions of Y and

X, put

$$Y \leftarrow \frac{1}{\lambda} \log \frac{V}{1-V} \ , \ X \leftarrow a e^Y \ .$$

Pointed out by Edmund Crouch.

414 Last part of Example 3.1: $\cdots$ and U is uniformly distributed.

415 Last inequality in the algorithm: " UNTIL $Z + E \leq d + X$ " should be " UNTIL $Z + E \geq d + X$ ". Pointed out by Jeff Miller.

418 ... (X is beta(a, b) distributed) ... and ... (X is gamma(a) distributed) ... are misleading comments: they apply to the returned values, not X. Pointed out by Francois Dufresne.

419 Last line: IX.3.4, not IX.3.7.

420 Line 1: Johnk (1964) instead of Johnk (1971). Line 2: IX.3.5, not IX.3.8.

423 Exercise 2: $a > b > 0$, not $b > a > 0$.

427 Last line: the exponent $b - 1$ should be $a + b$.

430 Part D: replace beta (a, b) by beta $(a/2, b/2)$.

436 On line -4, replace $2\sin(2\Theta)$ by $(1/2)\sin(2\Theta)$. In Theorem 4.3, Ulrich's property is valid for $a \geq 1/2$ only. In the proof of Theorem 4.3, mention that Ulrich's part can be obtained via the polar method by invoking Theorem 5.4.3 and Exercise 5.4.6.

437 First line following the algorithm: replace $a > 0$ by $a \geq 1/2$.

438 Line -3 in algorithm BA: insert log in front of $\frac{U_1}{1-U_1}$. Pointed out by Marron.

445 Exercise 2: $\sqrt{2a}N$ should read $\sqrt{a/2}N$.

448 Line -3: replace e^{1-x^2} by e^{x^2-1}.

450 Line -3 from bottom of algorithm: replace $\frac{a+1}{a+Z}$ by $\frac{a+Z}{a+1}$. Replace $1 - Z$ by $Z - 1$. Pointed out by W. Hörmann.

451 pol.II: RETURN $X \leftarrow V_1/V_2$.

461 Just after the two summation signs, the indices should be j and not n. Pointed out by François Dufresne.

469 Line -12: replace "X^2 is a type II Bessel..." by "$\sqrt{X}$ is a type II Bessel...".

473 Michael Slifker pointed out that the definition of the wrapped Cauchy distribution function in line -5 should be

$$G(x) = \frac{1}{2} + \frac{\text{sign}(x)}{2\pi} \arccos\left(\frac{(1+\rho^2)\cos(x) - 2\rho}{1 + \rho^2 - 2\rho\cos(x)}\right) = \frac{1}{2} + \frac{1}{\pi} \arctan\left(\frac{1+\rho}{1-\rho}\tan(x/2)\right) \ (|x| \leq \pi) \ .$$

474 Last line of algorithm: replace $1/\cos$ by $\cos^{\text{inv}}$. Last line of page: limit should be 1, not ∞. Both pointed out by Fisher.

475 Lines 5, 9: ... a local maximum value of "$hI_0(\kappa)(1-\rho^2)$".

Line -6: Replace $/(2r)$ be $/(2\kappa)$. Discovered by H.S.H. Chin and Duncan Murdoch.

Line -3: The remaining statements are left...

476 In the algorithm set-up, remind the reader that $r = 1 + \sqrt{1+4\kappa^2}$, $\rho = (r - \sqrt{2r})/(2\kappa)$, before defining s.

Last line of algorithm: replace $1/\cos$ by $\cos^{\text{inv}}$. Pointed out by Fisher.

Replace definition of V by "V is uniform $[0,1]$". Leave definition of U intact in the algorithm.

Replace "Accept" line by

$$\text{Accept} \leftarrow [Y(2-Y) - V \geq 0] \text{ (Quick acceptance step)}$$

Replace "IF NOT Accept" line by

$$\text{IF NOT Accept THEN Accept} \leftarrow [\log(Y/V) + 1 - Y \geq 0]$$

(Last two things found with Boris Shukhman.)

477 In the Burr X definition, replace + by -.

In line -6, replace $(1+x^c)^k$ by $(1+x^{-c})^k$.

479 Note that our expression for m on page 479 should be corrected to read

$$m = \frac{\lambda - 1}{\psi} + \sqrt{1 + (\frac{\lambda - 1}{\psi})^2}.$$

480 Line 5:) missing. Also: When,..., and is should become When,..... It is $\cdots$. Line -2: "a simple transformation of" the Pearson IV density is log-concave $\cdots$.

481 Last line: are all have: omit "are". In the generator for the Pearson I density, use X gamma $(b+1)$ and Y gamma $(d+1)$. (Found by Russell Davidson, McGill University.)

484 fitting of parameters; omit "of".

508 Last line: $-\log$ should be log. (Wolfgang Hörmann)

509 Top inequality following "Then": $-j^2/(2\mu)$ should read $-(j+1)^2/(2\mu)$. (Wolfgang Hörmann)

511 The error in Lemma 3.8 requires a change in the algorithm on page 511: implement

the following changes:

$c_3 \leftarrow c_2 + 1$	Replace by $c_3 \leftarrow c_2 + 2$
$Y \leftarrow -\lvert N\rvert\sqrt{\mu}$	Replace by $Y \leftarrow -\lvert N\rvert\sqrt{\mu} - 1$
$X \geq -\mu$	Replace by $X < -\mu$
$X \leq \delta$	Replace by $X > \delta$

511 Edmund Crouch suggested another fix-up.

513 The change in the algorithm on page 511 forces the following changes on page 513: "with the atoms at 0, 1 and -1 having areas 1, $\exp(1/78)$ and 1 respectively". Three lines lower, in the long expression, replace $+1$ by $+2$.

514 Last line: misplaced !, which belongs with μ!.

519 Example 11: Hannah.

536 Line -3:...i minus... should be $\cdots i - 1$ minus $\cdots$.

537 Algorithm: insert after ELSE but before $S \leftarrow -S$ the statement $X \leftarrow X - S$.

545 Example 7: "all constants" should be "any constant".

547 Second line of the proof: replace $Y(1-Y)^{i-1}$ by $(1-Y)Y^{i-1}$. Pointed out by Bruno Remillard.

548 Middle of the page: "He notes that" should be "She notes that". Forgive me, Adrienne.

548 Last two lines of the page: interchange $X \leftarrow 1$ and $X \leftarrow 2$. Pointed out by Marius Hofert.

559 $Sum \leftarrow 1$, RETURN $(X_1, \ldots, X_d)$ part: P_i/S should be p_i/Sum. Pointed out by Chi-Tak.

568 Omit the sentence "Thus, if the set of vertices is minimal for a convex polytope P, then it is in general position." (David Di Lorenzo)

570 Replace "Rubinstein (1982)" on line -7 by "Wilks (1962), Patel and Smith (1978), and Rubinstein (1982)".

585 $\log(1-2c)$ and $c \in [0,1]$ form a contradiction. Pointed out by Chi-Tak.

588 Example 2: (Plackett(1965)).

589 Exercise 3: the entry for the Farlie distribution should have parameter range

$$-1/\max(1, mn) \leq a \leq 1/\max(m, n)$$

and $m, n \geq 0$. For the Kimeldorf-Sampson entry, the range can be extended to include $|a| \leq 1/2$ and $-1/8 \leq b \leq 1/4$. Both changes were pointed out in Stefănescu

and Stefănescu (1991).

595 In Theorem 4.2, replace $X_i = Y_i \prod_{j=1}^{i-1} Y_j$ by $X_i = Y_i \prod_{j=1}^{i-1}(1 - Y_j)$

616 $A[k] \leftarrow Z$ should be $A[i] < -Z$. Pointed out by Chi-Tak.

622 line -3: Y should be X. Pointed out by Chi-Tak.

628 Linked list = stack. Pointed out by Chi-Tak.

641 Example 1: replace N by n. Pointed out by Chi-Tak.

646 Replace $\binom{n}{1}$ by $\binom{n}{0}$.

662 line -2 cannot be found. Pointed out by Chi-Tak.

684 Replace "In exercises 2.2 and 2.3" by "In exercises 2.2 through 2.5". Also, add that Krein's condition applies only to densities that are almost everywhere positive (pointed out by Tony Pakes).

691 Line 2: μ_5 should be μ_4.

696 In theorem 3.1, by two finite moments, we mean finite first and second moment. And "absolutely integrable" in that theorem should read "absolutely integrable derivatives". Pointed out by W. Hörmann.

700 $f^{(2n)}(0)$ twice.

777 ad infinitum.

785 Atkinson reference: gewnerating.

796 Hickey Computing]. Omit the].

809 Nijenhuis and Wilf: the second edition is 1978.

822 Collapse entries for "convex density" and "convex densities".

824 Collapse entries for extreme value distribution.

834 Collapse "Pearson system" and "Pearson's system" into one.

Replace Kingston (1984) reference to a Tech Report by a 1986 reference to SIAM Comp.