# MSG800/MVE170 Basic Stochastic Processes Fall 2014

# List of Errata for Hsu's book, Version 13 December 2012

**Equation 2.41.** $F_X(X)$ should be $F_X(x)$.

**Page 60.** On row 6 $|x|$ should be $\lfloor x \rfloor$.

**Equation 3.14.** It should be $\lim_{x\to\infty}$ instead of $\lim_{y\to\infty}$.

**Figure 3.4.** It should be $P(Y=0|X=1)$ instead of $P(Y=1|X=1)$ on the diagonal.

**Problem 4.100.** $X''$ should be corrected to $X^n$.

**Equation 5.28** is wrong as is the proof of (another version of) that formula in Problem 5.25: The second equality in the three line equation on the middle of page 234 is erroneous. To see this we may send $x_{n-1} \to \infty$ on both sides of the equation to obtain

$$F_X(x_1,\ldots,x_{n-2},x_n;t_1,\ldots,t_{n-2},t_n) = F_X(x_n;t_n) \times F_X(x_1,\ldots,x_{n-2};t_1,\ldots,t_{n-2}),$$

which is to say that $X(t_n)$ is independent of $X(t_1),...,X(t_{n-2})$. This is absurd as this need not hold at all for a Markov process (as is e.g., exemplified by a Poisson process).

A correct version of Equation 5.28 is the formula for PMF's given in Problem 5.88.

**Page 210.** The definition of wide-sense stationarity should be the conditions (5.21)-(5.22).

**Equation 5.29.** It should be $E[X(t_i)]$ instead of just $E[X(t_i)$.

**Page 215.** On row 3 from the bottom (Prob. 5.74) should be (Prob. 5.94).

**Lemma 5.8.1.** It should be $T_1$ and $T_2$ instead of $n_1$ and $n_2$, respectively.

**Equation 5.121.** It should be $\cos\omega\tau$ instead of $\cos\omega t$.

**Problem 5.37.** It should be $\gcd\{2,4,6,\ldots\}$ instead of $\gcd\{2,5,6,\ldots\}$.

**Problem 5.49.** Four occurances of $X(t+\Delta t)-X(0)$ should be $X(t+\Delta t)-X(t)$.

**Equation 5.202.** It should be $\sigma$'s instead of $a$'s in the $\mathbf{K_X}$-matrix.

**Problem 5.70.** On row 2 the alternative possible value of $X_i$ should not be 0 but $-1$ with probablity $q=1-p$. Such a random variable is not called Bernoulli distributed.

**Problem 5.72.** On row 11 $\frac{n(n-1)}{2}$ should be $n(n-1)$ and $\frac{n(n+3)}{2}$ should be $n(n+1)$.

**Problem 5.74.** On row 7 it should be $\frac{n+2-k}{n+2}$ instead of $\frac{n+2+k}{n+2}$.

**Problem 5.76.** Change $E(|g(Xn|)$ to $E(|g(X_n)|)$.

**Problem 5.77.** The calculation on row 4 of the problem should be corrected to

$$\mathbf{E}\{|X_n|\} = \mathbf{E}\big\{|\mathbf{E}\{X\,|F_n\}|\big\} \le \mathbf{E}\big\{\mathbf{E}\{|X||F_n\}\big\} = \mathbf{E}\{|X|\} < \infty.$$

The initial condition should be $\mathbf{E}\{|X|\} < \infty$ instead of $\mathbf{E}\{X\} < \infty$ accordingly.

**Problem 5.78.** Theorem 5.82 should be Theorem 5.8.2 at two occurances.

**Problem 5.79.** On row 8 of page 265 a $\}$ is missing.

**Page 266.** On row 11 $s_n$ should be $S_n$ and on row -4 the first $\frac{a}{a+b}$ should be $\frac{b}{a+b}$.

**Problem 5.82.** It should be $X(t) - \lambda t$ instead of $x(t) - \lambda t$ at two places.

**Problem 6.8 b.** In the solution it should be $\partial^2 R_X(s-t)/\partial t \partial s = -d^2 R_X(\tau)/d\tau^2$.

**Page 288.** On row 8 it should be $E[X(s)X(\beta)]$ and on row 12 the second $s^3$ should be $s^2$.

**Equation 6.137.** It should be $R_{X'}(t,s)$ instead of $R_X(t,s)$.

**Page 295.** On the last line $\frac{a}{(a^2+b^2)b}$ should be $\frac{a}{(a^2-b^2)b}$.

**Equation 9.20.** In the sum it should be $(s\rho)^n$ instead of just $(s\rho)$.

**Equations 9.22 and 9.36.** Correct $p$ to $\rho$ in the former and $\rho_0$ to $p_0$ in the latter.

**Equation 9.39.** On the right-hand side $L_q$ should be divided by $\lambda_e = \lambda\,(1 - p_K)$.

**Problem 9.13.** On row 9 (9.16) should be (9.17). In the evaluation of $W_q$ at the end $-1/\mu = -3$ has been forgotten in the middle term (but the answer 6.39 min is right).

**Problem 9.16.** The "balance equation" (9.2) $L = \lambda\,W$ holds for all steady-state queues provided that we set the total time spent in the system to zero for customers arriving when the system is full for queues with $K < \infty$, i.e., if we interpret the fact that customers arriving to a full system bounces away as that they spend zero time in system.

If we instead (as is custom and as is done in the book) define $W$ as the expected total time spent in the system for customers that really join the system, then we must divide the $W$ from the previous paragraph by $1 - p_K$ to get this $W$. And then we have Equation 9.31 $L = \lambda\,(1 - p_K)\,W$ for this alternative (and customary) definition of $W$.

In Problem 9.16 the sum in the last equation of page 362 should only run to $K - 1$, giving $W_q = (L - K\,p_K)/\mu$. The sum in first formula on page 363 should also only run to $K - 1$ giving $W = (L+1 - (K+1)\,p_K)/\mu$. Now, here we are dealing with the first definition of $W$ from above, i.e., we assign zero time in the system for bouncing customers and let that zero influence the mean value $W$, so that $L = \lambda\,W$ for this $W$.

As we want the customary definition of $W$ to be the expected total time spent in the system for customers that really joins the system we have to divide the $W$ obtained in the previous paragraph by $1 - p_K$ giving the following correct version of Equation 9.59: $W = (L+1 - (K+1)\,p_K)/(\mu\,(1 - p_K))$. The corresponding correct version of Equation 9.58 is $W_q = (L+1 - (K+1)\,p_K)/(\mu\,(1 - p_K)) - 1/\mu = (L - K\,p_K)/(\mu\,(1 - p_K))$.

**Problem 9.18.** On row 3 from the bottom $p^m$ should be $\rho^m$.

**Problem 9.29.** Hsu has used the faulty Equation 9.59 (see above) to obtain $W = (L + 1)/\mu = \ldots = 0.336$ hours $= 20.15$ minutes, while a correct answer comes from using the correct version of that formula from above $W = (L + 1 - (K + 1)\,p_K)/(\mu\,(1 - p_K)) = (L - K\,p_K)/(\mu\,(1 - p_K)) + 1/\mu = 7/57 + 1/6 = 0.289$ hours $= 17.4$ minutes (or from using Equation 9.31). The answer to task b is $W_q = W - 1/\mu = W - 10$ minutes $= 7.4$ minutes.

**Problem 9.30.** The correct answer is 1.

**Table B-2.** In Formula 11 the right hand side should be $X(\omega) = (\pi/a)\,\mathrm{e}^{-a|w|}$.