Supporting information for the paper: Stochastic Analysis of the SOS Response in *Escherichia coli*

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I. RATE EQUATIONS FOR THE SOS MODEL

Below we introduce the notation for the SOS model. The number of reporter genes is denoted by n. We denote the number of *recA* mRNAs, *lexA* mRNAs, and reporter gene mRNAs by m_R, m_L, and m_G, respectively. We denote the number of RecA, LexA, and GFP proteins by R, L, and G, respectively. The number of LexA proteins that are bound to the promoter site of *recA*, *lexA*, and the reporter gene are denoted by b_R, b_L, and b_G, respectively. For convenience, we also use the number of free promoter sites of each gene, denoting them by f_i, $i = L$,R or G. The rate constant for the transcription of *recA* mRNAs, *lexA* mRNAs, and the reporter gene mRNAs are denoted by g_{m_R}, g_{m_L}, and g_{m_G}, respectively. The translation rate constants of the RecA, LexA, and GFP proteins are denoted by g_R, g_L, and g_G, respectively. The degradation rate constants are denoted by d_j, where $j = m_R, m_L, m_G$ for mRNA molecules and $j = R, L$, and G for proteins. The rate constant for the binding of LexA proteins to the promoter site of *recA*, *lexA*, and the reporter gene are denoted by c_R, c_L, and c_G, respectively, while their dissociation rate constants are denoted by s_R, s_L, and s_G, respectively. The rate constant for the binding of RecA and LexA proteins is denoted by c_p. We note that when RecA proteins mark LexA for cleavage, RecA proteins remain unaffected. The rate equations for the SOS model take the form

$$\frac{dm_R}{dt} = g_{m_R}(1 - b_R) - d_{m_R} m_R, \quad (1)$$

$$\frac{dm_L}{dt} = g_{m_L}(1 - b_L) - d_{m_L} m_L, \quad (2)$$

$$\frac{dR}{dt} = g_R m_R - d_R R, \quad (3)$$

$$\frac{dL}{dt} = g_L m_L - d_L L - c_L(1 - b_L)L + s_L b_L - c_R(1 - b_R)L + s_R b_R - c_G(n - b_G)L + s_G b_G - c_p RL, \quad (4)$$

$$\frac{db_R}{dt} = c_R(1 - b_R)L - s_R b_R, \quad (5)$$

$$\frac{db_L}{dt} = c_L(1 - b_L)L - s_L b_L, \quad (6)$$

$$\frac{dm_G}{dt} = g_{m_G}(n - b_G) - d_{m_G} m_G, \quad (7)$$

$$\frac{dG}{dt} = g_G m_G, \quad (8)$$

$$\frac{db_G}{dt} = c_G(n - b_G)L - s_G b_G. \quad (9)$$