BEAST FORMULA:

$\text{Prediction}_{block} : block \in (1,...,5) = \frac{1}{4000}\Sigma_{i=1}^{4000}\frac{1}{5}\Sigma_{trial=5*(block-1)+1}^{5*block} I_{decision_{trial,i}<0} + b_{trial,i} I_{decision_{trial,i}=0}$:

$b_{trial,i} \sim Bernoulli(0.5), decision_{trial,i} = E_{p_a} - BEVb_{trial,i} + STa_{trial,i} - STb_{trial,i} + error_{trial,i}$

$p_y : y \in (a,b) =$

$$\text{if LotShapeY='-',} x = \begin{cases} Hy & \text{w.p } pHy \\ Ly & \text{w.p } 1-pHy \end{cases}$$

$$\text{if LotShapeY='Symm',} x = \begin{cases} Hy - \frac{LotNumY-1}{2} + i_{i=0...,LotNumY-1} & \text{w.p } p(c=i)*pHy : c \sim Bin(LotNumY-1, 0.5) \\ Ly & \text{w.p } 1-pHy \end{cases}$$

$$\text{if LotShapeY='R-skew',} x = \begin{cases} Hy-1-LotNumY+2^i{}_{i=1...,LotNumY-1} & \text{w.p } \frac{pHy}{2^i} \\ 2(Hy-1-LotNumY+2^i)_{i=LotNumY} & \text{w.p } \frac{pHy}{2^i} \\ Ly & \text{w.p } 1-pHy \end{cases}$$

$$\text{if LotShapeY='L-skew',} x = \begin{cases} Hy+1+LotNumY-2^i{}_{i=1...,LotNumY-1} & \text{w.p } \frac{pHy}{2^i} \\ 2(Hy+1+LotNumY-2^i)_{i=LotNumY} & \text{w.p } \frac{pHy}{2^i} \\ Ly & \text{w.p } 1-pHy \end{cases}$$

$rndNumObs_{trial,i} \sim U([0,1]), u_{trial,i} \sim U([0,1])$

$$ObsPayA_{trial,i} = \begin{cases} Max(x : P_a(x) \le rndNumObs_{trial,i}) & trial > 5 \end{cases}$$

$$ObsPayB_{trial,i} = \begin{cases} Max(x : P_b(x) \le rndNumObs_{trial,i}) & corr = 1 \text{ and } trial > 5 \\ Max(x : P_b(x) \le 1 - rndNumObs_{trial,i}) & corr = -1 \text{ and } trial > 5 \\ Max(x : P_b(x) \le u_{trial,i}) & corr = 0 \text{ and } trial > 5 \end{cases}$$

$Y : Y \in (A,B) = \{x : p_y(x) > 0\}, psi_i \sim U([0, 0.07])$

$$BEVb_{trial,i} = \begin{cases} E_{p_b} & amb = 0 \\ \frac{(1-psi_i)(E_{U(B)}+E_{p_a})}{2} + psi_i Min(B) & amb = 1 \text{ and } trial \le 5 \\ \frac{19}{20}^{trial-5}(\frac{(1-psi_i)(E_{U(B)}+E_{p_a})}{2} + psi_i Min(B)) + \frac{1}{20}\Sigma_{j=6}^{trial}\frac{19}{20}^{trial-j} ObsPayB_{j,i} & else \end{cases}$$

$$pEstB_{trial,i} : x = \begin{cases} Min(B) & \text{w.p } Min(1, Max(0, \frac{BEVb_{trial,i} - \overline{B \setminus Min(B)\}}}{Min(B) - \overline{B}})) \\ y : y \in B \setminus \{Min(B)\} & \text{w.p } \frac{1 - Min(1, Max(0, \frac{BEVb_{trial,i} - \overline{B \setminus Min(B)\}}}{Min(B) - \overline{B}}))}{|B|-1} \end{cases}$$

$beta_i \sim U([0, 2.6]), theta_i \sim U([0,1])$

$$pBias_{trial,i} = \begin{cases} \frac{beta_i}{beta_i+1} & trial \le 5 \\ \frac{beta_i}{beta_i+1+(trial-5)^{theta_i}} & else \end{cases}$$

$rndNum1_{trial,i,j} \sim U([0,1]), rndNum2_{trial,i,j} \sim U([0,1]), gama_i \sim U([0, 0.5])$

$Maximal = Max(Max(A), Max(B)), Range = Maximal - Min(Min(A), Min(B))$

$$RatioMin = \begin{cases} 1 & Min(A) = Min(B) \\ \frac{Min(|Min(A)|,|Min(B)|)}{Max(|Max(A)|,|Max(B)|)} & Min(A) \neq Min(B) \text{ and } Sign(Min(A)) = Sign(Min(B)) \\ 0 & else \end{cases}$$

$y_j : y \in \{a, b\}, j \in \{1, ..., 5\} = x \in Y : |k \in Y : k \geq x| = LotNumY - j$

$outcomeY_{trial,i,j} : Y \in (A, B) =$

$$\begin{cases} Max(x : P_y(x) \leq rndNum2_{trial,i,j}) & pBias_{trial,i} < rndNum1_{trial,i,j} \text{ and } trail \leq 5 \text{ and (Y=a or (Y=b and amb=0))} \\ Max(x : PEst_{trial,i}(x) \leq rndNum2_{trial,i,j}) & pBias_{trial,i} < rndNum1_{trial,i,j} \text{ and } trail \leq 5 \text{ and Y=b and amb=1} \\ ObsPayY_{max(x:\frac{x-6+1}{trial-6+1} \leq rndNum2_{trial,i,j}),i} & pBias_{trial,i} < rndNum1_{trial,i,j} \text{ and } trail > 5 \\ \text{Min(Y)} & 1.5rndNum1_{trial,i,j} \leq pBias_{trial,i} < 3rndNum1_{trial,i,j} \text{ and } Sign(Maximal) > 0 \text{ and } RatioMin < gama_i \\ Range * Sign(Max(x : P_y(x) \leq rndNum2_{trial,i,j})) & pBias_{trial,i} \geq 3rndNum1_{trial,i,j} \text{ and } trail \leq 5 \text{ and (Y=a or (Y=b and amb=0))} \\ Range * Sign(Max(x : PEst_{trial,i}(x) \leq rndNum2_{trial,i,j})) & pBias_{trial,i} \geq 3rndNum1_{trial,i,j} \text{ and } trail \leq 5 \text{ and Y=b and amb=1} \\ Range * Sign(ObsPayY_{max(x:\frac{x-6+1}{trial-6+1} \leq rndNum2_{trial,i,j}),i}) & pBias_{trial,i} \geq 3rndNum1_{trial,i,j} \text{ and } trail > 5 \\ y_{max(x:\frac{x}{LotNumY} \leq rndNum2_{trial,i,j})} & \text{else} \end{cases}$$

$kapa_i \sim U(\{1, 2, 3\})$

$STy_{trial,i} : y \in (a, b) = \frac{1}{kapa_i} \Sigma_{j=1}^{kapa_i} outcomeY_{trial,i,j}$

$sigma_i \sim U([0, 7])$

$$error_{trial,i} = \begin{cases} 0 & \text{a dominates stochastically b or b dominates stochastically a}^* : a \sim p_a, b \sim p_b \\ sigma_i N(0, 1) & else \end{cases}$$

$*(P(a \geq x) \geq P(b \geq x) \forall x \wedge \exists x : P(a \geq x) > P(b \geq x)) \vee (P(b \geq x) \geq P(a \geq x) \forall x \wedge \exists x : P(b \geq x) > P(a \geq x))$