

■ Initializations (Evaluate this cell first)

■ The Monty Hall Problem: Animation

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LINE[γ_] := Plot[- $\frac{(-1+c)\gamma}{1+\gamma}$ , {c, 0, 1},
  DisplayFunction -> Identity, PlotStyle -> Thickness[.005]];
LINE1[γ_] := Plot[- $\frac{(-1+c)\gamma}{1+\gamma}$ , {c, 0, 1}, DisplayFunction -> Identity];
sol = {a -> γ - cγ - dγ, b -> 0, e -> 0, f -> 0, g -> 0, h -> 1 - (a + b + c + d + e + f + g)};
INEQ1 = InequalitySolve[
  (0 < a < 1 && 0 ≤ b ≤ 1 && 0 < c < 1 && 0 < d < 1 && 0 ≤ e ≤ 1 && 0 ≤ f ≤ 1 && 0 ≤ g ≤ 1 &&
  0 ≤ h ≤ 1 && a + b + c + d + e + f + g + h == 1 && Pr[E1 | H2] > Pr[E1 | ¬(H1 ∪ H2)] &&
  Pr[E1 | ¬H2] ≤ Pr[E1 | H1 ∪ H2]) // . sol, {a, b, c, d, e, f, g, h, γ}];
INEQ2 = InequalitySolve[(0 < a < 1 && 0 ≤ b ≤ 1 && 0 < c < 1 && 0 < d < 1 &&
  0 ≤ e ≤ 1 && 0 ≤ f ≤ 1 && 0 ≤ g ≤ 1 && 0 ≤ h ≤ 1 && a + b + c + d + e + f + g + h == 1 &&
  Pr[¬(H1 ∪ H2) | E1] - Pr[¬(H1 ∪ H2)] < Pr[H2 | E1] - Pr[H2]) // .
  sol, {a, b, c, d, e, f, g, h, γ}];
INEQ3 = InequalitySolve[ $\left(0 < a < 1 \&\& 0 \leq b \leq 1 \&\& 0 < c < 1 \&\& 0 < d < 1 \&\& 0 \leq e \leq 1 \&\& 0 \leq f \leq 1 \&\& 0 \leq g \leq 1 \&\& 0 \leq h \leq 1 \&\& a + b + c + d + e + f + g + h == 1 \&\& \frac{\Pr[E1 | H2]}{\Pr[E1 | \neg H2]} > \frac{\Pr[E1 | \neg (H1 \cup H2)]}{\Pr[E1 | H1 \cup H2]}\right)$  // . sol, {a, b, c, d, e, f, g, h, γ}];
IP1[g_] := InequalityPlot[INEQ1 // . γ -> g, {c, 0, 1}, {d, 0, 1},
  PlotRange -> {{0, 1}, {0, 1}}, DisplayFunction -> Identity,
  PlotStyle -> {{RGBColor[1, 0, 0]}}, Curves -> Front, Fills -> {GrayLevel[1]}];
IP2[g_] := InequalityPlot[INEQ2 // . γ -> g, {c, 0, 1}, {d, 0, 1},
  PlotRange -> {{0, 1}, {0, 1}}, DisplayFunction -> Identity,
  PlotStyle -> {{RGBColor[0, 1, 0]}}, Curves -> Front, Fills -> {GrayLevel[1]}];
IP3[g_] := InequalityPlot[INEQ3 // . γ -> g, {c, 0, 1}, {d, 0, 1},
  PlotRange -> {{0, 1}, {0, 1}}, DisplayFunction -> Identity,
  PlotStyle -> {{RGBColor[0, 0, 1]}}, Curves -> Front, Fills -> {GrayLevel[1]}];
pt = Show[Graphics[{AbsolutePointSize[6], Point[{1/3, 1/3}]}],
  DisplayFunction -> Identity];
Clear[i];
Table[Show[{IP3[i], IP2[i], IP1[i], pt, LINE1[i], LINE[10000]},
  Graphics[Text["Pr(E | H3) = " <> ToString[i], {.7, .7}]], AxesLabel ->
  {"Pr(H1)", "Pr(H2)"}, DisplayFunction -> $DisplayFunction], {i, .1, 1, .1}];

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