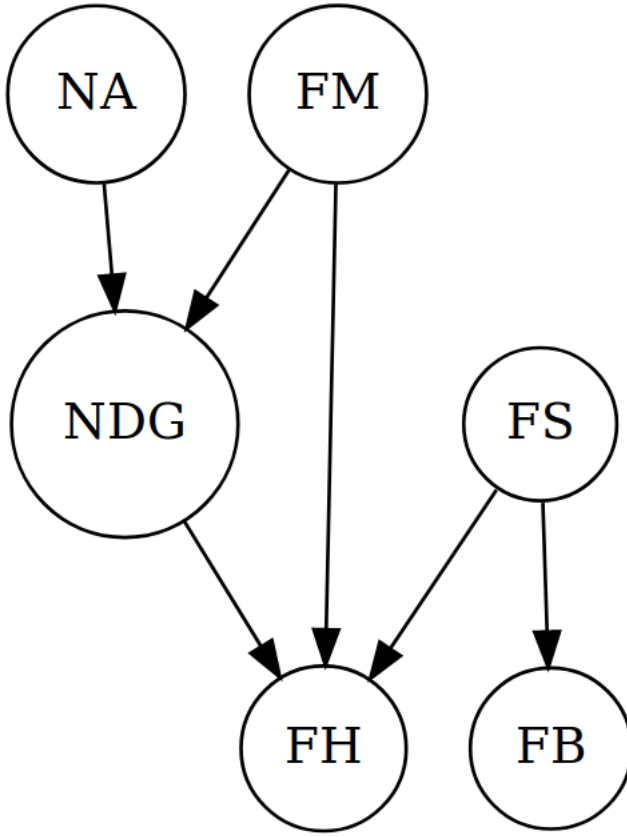


- Q 1**
- 1) Independent as "every X_i 's conditionally independent of all of its nondescendents given its parent". a, b have no parents and neither is a descendent of the other. Undirected path: a - c - b
 - 2) Same reason as above. Undirected path: a - c - b
 - 3) Not all paths are d-separated. Undirected path: a - c - b - e
 - 4) Independence. A is only connected to C, which is in evidence set. All paths blocked.
 - 5) Independent because E is conditioned on all of its parents (Just B) and hence independent to all non-descendants. Another proof, path a-c-b-e is blocked by b and path a-c-d-e has case three blocking because none of [d,h,g] are in evidence.
 - 6) Same as 4. Independence. A is only connected to C, which is in evidence set. All paths blocked.
 - 7) Not d-separated, path a-c-d-e does not have type 3 blocking because E is in evidence.
 - 8) Like 3. Not all paths are d-separated. Undirected path: a - c - b - e.
 - 9) Path f-c-d-h is not blocked, not d-separated.
 - 10) Only path e-d-g-j is type-3 blocked. Both arcs enter G but G (and its 0 descendents) are not in evidence. Hence d-separated and independent.
 - 11) Not d-separated as path e-d-g-j is no longer type-3 blocked. Both arcs enter G but G is now in evidence.
 - 12) Same results as 10. Only path e-d-g-j is type-3 blocked. Both arcs enter G but G (and its 0 descendents) are not in evidence. Hence d-separated and independent.
 - 13) All paths are not blocked. For example, path a - c - d - g . Not conditionally independent.
 - 14) Independence. A is only connected to C, which is in evidence set. Hence all paths are blocked, d-separated and thus conditionally independent.
 - 15) As above. A is only connected to C, which is in evidence set. Hence all paths are blocked, d-separated and thus conditionally independent.

Q 3 1) Below is the bayes net constructed via the descibed situation.



The following are the joint probabilities for the bayes net.

$$P(FS) = 0.05, P(\sim FS) = 0.95$$

$$P(FM) = \frac{1}{28}, P(\sim FM) = \frac{27}{28}$$

$$P(NA) = 0.3, P(\sim NA) = 0.7$$

$$P(NDG|FM, NA) = 0.8, P(NDG|FM, \sim NA) = 0.4,$$

$$P(NDG|\sim FM, NA) = 0.5, P(NDG|\sim FM, \sim NA) = 0.0,$$

$$P(FB|FS) = 0.6, P(FB|\sim FS) = 0.1$$

For FH , a table was used to simplify the nomenclature.

P(FH)	FM, NDG	FM, $\sim NDG$	$\sim FM$, NDG	$\sim FM$, $\sim NDG$
FS	0.99	0.9	0.75	0.5
$\sim FS$	0.65	0.4	0.2	0

2)

$$\begin{aligned}
 P(NDG) &= P(NDG|FM, NA)P(FM)P(NA) \\
 &\quad + P(NDG|FM, \sim NA)P(FM)P(\sim NA) \\
 &\quad + P(NDG|\sim FM, NA)P(\sim FM)P(NA) \\
 &\quad + P(NDG|\sim FM, \sim NA)P(\sim FM)P(\sim NA) \\
 &= 0.8 \times \frac{1}{28} \times 0.3 + 0.5 \times \frac{27}{28} \times 0.3 \\
 &\quad + 0.4 \times \frac{1}{28} \times 0.7 + 0 \times P(\sim FM)P(\sim NA) \\
 &= 0.1632
 \end{aligned}$$

Using the notation of the table above, a similar one can be made for the prior over the conditions (i.e. instead of $P(FH|FS, FM, NDG)$, $P(FS)P(FM)P(NDG)$). This allows for $P(FH)$ to be the summation of scalar multiplication of table entries.

	FM, NDG	FM, $\sim NDG$	$\sim FM$, NDG	$\sim FM$, $\sim NDG$
FS	0.00029	0.0015	0.0079	0.0403
$\sim FS$	0.0055	0.028	0.150	0.767

$$\begin{aligned}
P(FH) &= \sum_{fs \in \{0,1\}} \sum_{fm \in \{0,1\}} \sum_{ndg \in \{0,1\}} P(NDG|FH = fh, FM = fm, NDG = ndg) \\
&\quad \times P(FH = fh)P(FM = fm)P(NDG = ndg) \\
&= (0.00029 \times 0.99) + (0.0015 \times 0.9) + (0.0079 \times 0.75) + (0.0403 \times 0.5) \\
&\quad + (0.0055 \times 0.65) + (0.028 \times 0.4) + (0.15 \times 0.2) + (0.767 \times 0) \\
P(FH) &= 0.0724871
\end{aligned}$$

3)

$$\begin{aligned}
P(FH|FM) &= P(FH|NDG, FS)P(NDG)P(FS) \\
&\quad + P(FH|NDG, \sim FS)P(NDG)P(\sim FS) \\
&\quad + P(FH|\sim NDG, \sim FS)P(\sim NDG)P(\sim FS) \\
&\quad + P(FH|\sim NDG, FS)P(\sim NDG)P(FS) \\
&= 0.99 \times 0.1632 \times 0.05 \\
&\quad + 0.65 \times 0.1632 \times 0.95 \\
&\quad + 0.4 \times (1 - 0.1632) \times 0.95 \\
&\quad + 0.9 \times (1 - 0.1632) \times 0.05 \\
P(FH|FM) &= 0.4645
\end{aligned}$$

$$P(FS, FM, FH) = P(FS|FM, FH)P(FH|FM)P(FM)$$

$$P(FS|FM, FH) = \frac{P(FS, FM, FH)}{P(FH|FM)P(FM)}$$

$$\begin{aligned}
&= \frac{P(FH|FS, FM)P(FM|FS)P(FS)}{P(FH|FM)P(FM)} \\
&= P(FM)(FS) \times \frac{P(FH|FS, FM, NDG)P(NDG)}{P(FH|FM)P(FM)} \\
&\quad + P(FM)P(FS) \times \frac{P(FH|FS, FM, \sim NDG)P(\sim NDG)}{P(FH|FM)P(FM)} \\
&= \frac{(0.99 \times 0.1632 + 0.9 \times (1 - 0.1632))P(FM)P(FS)}{P(FH|FM)P(FM)} \\
&= \frac{(0.99 \times 0.1632 + 0.9 \times (1 - 0.1632))P(FS)}{P(FH|FM)} \\
&= \frac{(0.99 \times 0.1632 + 0.9 \times (1 - 0.1632)) \times 0.05}{0.4645} \\
&= 0.09846060576833651
\end{aligned}$$

4)

$$\begin{aligned}
P(FS, FM, FH, \sim FB) &= P(FS|FM, FH, \sim FB)P(\sim FB|FM, FH)P(FH|FM)P(FM) \\
P(FS, FM, FH, \sim FB) &= P(\sim FB|FS, FM, FH)P(FS|FM, FH)P(FH|FM)P(FM) \\
\therefore P(FS|FM, FH, \sim FB) &= \frac{P(\sim FB|FS, FM, FH)P(FS|FM, FH)}{P(\sim FB|FM, FH)} \\
&= \frac{0.414042986775 \times 0.09846060576833651}{0.232596} \\
&= 1.75269
\end{aligned}$$

$$\begin{aligned}
P(\sim FB|FS, FM, FH) &= \frac{P(FH|\sim FB, FS, FM)P(\sim FB, FS, FM)}{P(FS, FM, FH)} \\
&= \frac{(P(FH|FS, FM, NDG)P(NDG) + P(FH|FS, FM, \sim NDG)P(\sim NDG))}{P(FH|FS, FM)P(FM|FS)P(FS)} \\
&\quad \times \frac{P(\sim FB|FS, FM)P(FM|FS)P(FS)}{P(FH|FS, FM)P(FM|FS)P(FS)} \\
&= \frac{((0.99 \times 0.1632)0.9 \times (1 - 0.1632))(1 - 0.6)\frac{1}{28}0.05}{0.99 \times 0.1632 + 0.9 \times (1 - 0.1632)} \\
&= 0.41404298
\end{aligned}$$

$$\begin{aligned}
P(\sim FB|FM, FH) &= \frac{P(FH|FM, \sim FB)P(\sim FB)}{P(FH|FM)} \\
&= \frac{P(FH|FM, \sim FB)(1 - (P(FB|FS)P(FS) + P(FB|\sim FS)P(\sim FS)))}{P(FH|FM)} \\
&= \frac{0.019269 \times (1 - (0.6 \times 0.05 + 0.1 \times 0.95))}{0.4645} \\
&= 0.232596
\end{aligned}$$

Q 4 Value iteration was performed on the MDP to determine the optimal policy and corresponding value function for the states. Note, given that all actions in states S_i , $i > 1$ are singular and stochastic, the sole action dictated by the policy will be between a and b at S_1 . The optimal policy is then given by

$$\max(r_1 + \gamma \sum_{j=1}^5 P_{1j}^a V^*(S_j), r_1 + \gamma \sum_{j=1}^5 P_{1j}^b V^*(S_j))$$

The stopping criteria used was: $\max(\|V^{k+1}(S) - V^k(S)\|) < \epsilon = 0.0001$. Included in the submission is both the code used to perform value iteration as well as the value function $V^k(S)$ throughout the process (which, for clarity and brevity can be found in the appendix).

- 1) Setting $p_s = 0.2$, $p_r = 0.01$ the optimal policy is b. Increasing $p_r = 0.03$, however (which intuitively increases the expectation of negative reward from S_5) results in action a at S_1 being the optimal policy. Setting this $p_r = 0.018985$ results in a policy that is indifferent to either a or b. More precisely:

$$\max(\|\sum_{j=1}^5 P_{1j}^a V^*(S_j) - \sum_{j=1}^5 P_{1j}^b V^*(S_j)\|) < \epsilon = 0.0001$$

- 2) Setting $p_s = 0.6$, $p_r = 0.1$ the optimal policy is again b. Increasing $p_r = 0.2$, as before alters the optimal policy again to a. The threshold for this system (i.e. the optimal policy boundary given $p_s = 0.6$) is $p_r = 0.13762$.

Appendix 1: Value Iteration $V^k(S)$

MDP: $p_s = 0.2, p_r = 0.01$

$$\begin{aligned} V^0 &= [13.645822.76223.52212.4662 - 9.4338] \\ V^1 &= [21.40766113.79909212.68514122.8514480.770948] \\ V^2 &= [13.8319514619.9889279620.5333116830.474437728.37679021] \\ V^3 &= [18.8700168826.9584689827.7963812124.721390082.62211356] \\ V^4 &= [25.5585575323.9103655623.567501628.482396496.38296522] \\ V^5 &= [22.8714255226.1895907926.3814170534.5583943612.45894839] \\ V^6 &= [24.7288970131.2404019631.8437170632.8381162910.73866892] \\ V^7 &= [29.575623330.8926447530.891797834.2628279912.16338049] \\ V^8 &= [29.2228954731.9093517732.0194939738.5421265816.44267907] \\ V^9 &= [30.1528424135.3547930435.785425438.6470776616.54763014] \\ V^{10} &= [33.4610587536.089189736.2329220639.4521526417.35270513] \\ V^{11} &= [34.1579489436.8405820536.9637733542.3571597320.25771222] \\ V^{12} &= [34.8490313639.1911519839.5169852943.2289765221.129529] \\ V^{13} &= [37.097680440.3003410340.5049437743.9026745921.80322707] \\ V^{14} &= [38.1560065741.0230974841.1748116845.8892708323.78982331] \\ V^{15} &= [38.8292846142.6702343542.9369889246.9828663424.88341883] \\ V^{16} &= [40.3999075643.8143229544.0394199247.6624106425.56296313] \\ V^{17} &= [41.4916952544.5481534544.7251612449.0698499826.97040246] \\ V^{18} &= [42.1817239145.7572351445.993667350.1370351828.03758767] \\ V^{19} &= [43.3318493146.7980214247.0266187250.8283922828.72894477] \\ V^{20} &= [44.3242846947.5212022147.7158594351.8774284329.77798091] \\ V^{21} &= [45.0078668648.4558740248.678263252.8256191130.7261716] \\ V^{22} &= [45.8956623949.3540865949.5803945953.5001599831.40071247] \\ V^{23} &= [46.7513253150.0373980450.2428295254.3233065432.22385903] \\ V^{24} &= [47.3989951450.792818651.0095511455.1330972633.03364974] \\ V^{25} &= [48.1160707751.5517894551.7747607655.7637850933.66433757] \\ V^{26} &= [48.8384471752.1753166652.3866937756.4368000934.33735257] \\ V^{27} &= [49.4302756552.8052782353.0202552357.1183683435.01892083] \\ V^{28} &= [50.0281944153.442962853.6631844357.6891306835.58968316] \\ V^{29} &= [50.6347011653.9979022554.212264558.2545736436.15512612] \\ V^{30} &= [51.1617827654.5330773954.7478808358.8268539836.72740647] \\ V^{31} &= [51.6698074855.0696937355.2880640859.3318753837.23242787] \\ V^{32} &= [52.179926555.555467155.7711747959.8142135537.71476604] \\ V^{33} &= [52.6414474656.0143410556.2294694460.2961874538.19673993] \\ V^{34} &= [53.0771338856.4678272656.6850951160.7365753938.63712787] \\ V^{35} &= [53.5080840456.8886844757.1049112461.1509241339.05147662] \\ V^{36} &= [53.907967157.2835523957.4990619561.5587496539.45930213] \\ V^{37} &= [54.2829548457.6685246957.8851970861.9393930839.83994557] \\ V^{38} &= [54.6487242158.0309584358.2473300662.2961687340.19672122] \\ V^{39} &= [54.99309658.3709703458.5867758762.6427952340.54334772] \\ V^{40} &= [55.3160374958.6990087458.9153888862.9701626340.87071511] \\ V^{41} &= [55.6276810559.0101352659.2265062463.277377541.17792999] \\ V^{42} &= [55.9232925359.302732659.5187311163.5730181641.47357065] \\ V^{43} &= [56.2012278959.58301359.7992652363.8538518441.75440433] \\ V^{44} &= [56.4674884259.8496998760.0660287764.1181657742.01871825] \\ V^{45} &= [56.72086660.1012489660.3173597164.3709283542.27148084] \\ V^{46} &= [56.9598248260.3411428560.5573481664.6115786242.51213111] \\ V^{47} &= [57.1877160460.5696168960.7859030564.8387501942.73930268] \end{aligned}$$

$V^{48} = [57.4047801360.7856773661.0018474565.0551784842.95573097]$
 $V^{49} = [57.6100336960.9912143461.2074083665.2613289643.16188145]$
 $V^{50} = [57.8052873461.1869407461.4031953165.4564050543.35695754]$
 $V^{51} = [57.9912342961.3723865861.5885851265.6418791643.54243165]$
 $V^{52} = [58.1674075461.5485816161.7647775265.8184838343.71903632]$
 $V^{53} = [58.3347884961.7162782261.9325127965.9858894143.88644189]$
 $V^{54} = [58.4941033461.8753688162.0915794166.1449036644.04545614]$
 $V^{55} = [58.6452402162.0264468562.2426479266.2962242144.19677669]$
 $V^{56} = [58.7887617962.170155362.386378566.4398216844.34037417]$
 $V^{57} = [58.9252859862.3065939862.5228087466.5761743944.47672688]$
 $V^{58} = [59.0549036462.4361453962.6523511866.7058560844.60640857]$
 $V^{59} = [59.1779761162.5593182562.7755355666.8289989444.72955143]$
 $V^{60} = [59.2949906462.6763096662.8925252266.9459244744.84647696]$
 $V^{61} = [59.4061331862.7874014363.0036105767.0570798244.9576323]$
 $V^{62} = [59.5116696962.8929869363.109201567.1626664545.06321893]$
 $V^{63} = [59.611975962.9932940263.209509267.262930945.16348338]$
 $V^{64} = [59.7072680863.0885533463.3047645467.3582178345.25877032]$
 $V^{65} = [59.7977641563.1790706963.3952841267.448744945.34929739]$
 $V^{66} = [59.8837555263.2650695663.4812841367.5347191145.4352716]$
 $V^{67} = [59.9654547163.3467497463.5629620867.6164092945.51696177]$
 $V^{68} = [60.0430507863.4243535163.6405665967.6940226645.59457514]$
 $V^{69} = [60.1167742563.4980843963.7142984567.7677405745.66829305]$
 $V^{70} = [60.1868187363.5681188663.7843317967.8377773445.73832983]$
 $V^{71} = [60.2533514663.6346533663.850866467.9043188645.80487134]$
 $V^{72} = [60.3165591663.6978664763.9140801867.9675257945.86807827]$
 $V^{73} = [60.3766116763.7579142363.9741274168.0275730345.92812551]$
 $V^{74} = [60.4336570563.814959264.0311722968.0846224245.9851749]$
 $V^{75} = [60.4878497363.8691552964.0853687868.138815946.03936839]$
 $V^{76} = [60.5393360363.9206395964.1368528868.1902990346.09085152]$
 $V^{77} = [60.5882461463.9695487864.1857619468.2392107246.1397632]$
 $V^{78} = [60.6347098464.0160144164.232227868.2856754746.18622795]$
 $V^{79} = [60.678852264.0601560964.2763694168.3298160946.23036857]$
 $V^{80} = [60.7207868164.1020898864.318303168.3717511646.27230365]$
 $V^{81} = [60.7606238964.1419279664.3581412868.4115890846.31214157]$
 $V^{82} = [60.7984700764.1797740164.3959873368.4494343946.34998688]$
 $V^{83} = [60.8344238364.215727264.4319404568.4853881846.38594066]$
 $V^{84} = [60.8685793564.2498831864.4660964868.5195442546.42009674]$
 $V^{85} = [60.9010275364.2823314364.4985447568.5519920546.45254453]$
 $V^{86} = [60.9318533764.3131569364.529370268.5828177846.48337027]$
 $V^{87} = [60.9611375964.3424413364.5586546268.6121023246.51265481]$
 $V^{88} = [60.9889577764.3702616264.5864749268.6399223646.54047485]$
 $V^{89} = [61.0153870564.396690764.6129039968.6663515246.56690401]$
 $V^{90} = [61.0404946864.4217983964.6380116868.6914593246.59201181]$
 $V^{91} = [61.0643469864.4456507864.6618640868.7153115846.61586407]$
 $V^{92} = [61.0870067564.4683104564.6845237468.7379712746.63852375]$
 $V^{93} = [61.1085334464.4898371564.7060504468.7594980446.66005053]$
 $V^{94} = [61.128983864.5102875764.7265008768.779948446.68050089]$
 $V^{95} = [61.148411764.5297154364.7459287268.7993762546.69992873]$
 $V^{96} = [61.1668681664.5481718864.7643851768.8178327546.71838523]$
 $V^{97} = [61.1844017964.5657055564.7819188468.8353663946.73591888]$
 $V^{98} = [61.2010587864.5823625164.798575868.8520233446.75257583]$

$$\begin{aligned}
V^{99} &= [61.216882964.5981866264.8143999168.8678474746.76839996] \\
V^{100} &= [61.231915864.6132195464.8294328368.8828803946.78343287] \\
V^{101} &= [61.2461970764.627500864.843714168.8971616446.79771413] \\
V^{102} &= [61.2597642764.64106864.8572812968.9107288546.81128134] \\
V^{103} &= [61.2726531164.6539568564.8701701468.923617746.82417018] \\
V^{104} &= [61.2848975164.6662012564.8824145468.9358620946.83641458] \\
V^{105} &= [61.296529764.6778334364.8940467268.9474942746.84804676] \\
V^{106} &= [61.3075802664.68888464.9050972968.9585448546.85909733] \\
V^{107} &= [61.3180783164.6993820464.9155953468.9690428946.86959537] \\
V^{108} &= [61.3280514564.7093551864.9255684768.9790160346.87956851] \\
V^{109} &= [61.3375259364.7188296764.9350429668.9884905146.889043] \\
V^{110} &= [61.3465266964.7278304364.9440437268.9974912746.89804376] \\
V^{111} &= [61.3550774164.7363811564.9525944469.0060419946.90659448] \\
V^{112} &= [61.363200664.7445043364.9607176269.0141651846.91471767] \\
V^{113} &= [61.3709176364.7522213664.9684346569.021882246.92243469] \\
V^{114} &= [61.378248864.7595525364.9757658369.0292133846.92976587] \\
V^{115} &= [61.3852134264.7665171564.9827304469.03617846.93673048] \\
V^{116} &= [61.391829864.7731335464.9893468369.0427943846.94334687] \\
V^{117} &= [61.3981153764.779419164.9956323969.0490799546.94963243] \\
V^{118} &= [61.4040866664.7853903965.0016036869.0550512346.95560372] \\
V^{119} &= [61.4097593864.7910631165.007276469.0607239646.96127644] \\
V^{120} &= [61.4151484764.796452265.0126654969.0661130546.96666553] \\
V^{121} &= [61.420268164.8015718365.0177851269.0712326846.97178516] \\
V^{122} &= [61.4251317564.8064354865.0226487869.0760963346.97664882] \\
V^{123} &= [61.4297522264.8110559565.0272692469.080716846.98126928] \\
V^{124} &= [61.4341416664.815445465.0316586969.0851062446.98565873] \\
V^{125} &= [61.4383116464.8196153765.0358286669.0892762246.9898287] \\
V^{126} &= [61.4422731164.8235768465.0397901469.0932376946.99379018] \\
V^{127} &= [61.4460365164.8273402565.0435535469.0970010946.99755358] \\
V^{128} &= [61.4496117464.8309154865.0471287769.1005763247.00112881] \\
V^{129} &= [61.4530082164.8343119465.0505252469.1039727947.00452528] \\
V^{130} &= [61.4562348664.8375385965.0537518869.1071994447.00775192] \\
V^{131} &= [61.4593001764.840603965.056817269.1102647547.01081724] \\
V^{132} &= [61.4622122264.8435159565.0597292469.113176847.01372928] \\
V^{133} &= [61.4649786664.846282465.0624956969.1159432447.01649573] \\
V^{134} &= [61.4676067964.8489105265.0651238169.1185713747.01912385] \\
V^{135} &= [61.470103564.8514072465.0676205369.1210680847.02162057] \\
V^{136} &= [61.4724753864.8537791265.0699924169.1234399647.02399245] \\
V^{137} &= [61.4747286764.856032465.072245769.1256932547.02624574] \\
V^{138} &= [61.4768692964.8581730365.0743863269.1278338747.02838636] \\
V^{139} &= [61.4789028964.8602066265.0764199169.1298674647.03041995] \\
V^{140} &= [61.480834864.8621385365.0783518269.1317993847.03235186] \\
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V^{143} &= [61.4860700464.8673737765.0835870669.1370346247.0375871] \\
V^{144} &= [61.4876435964.8689473265.0851606269.1386081747.03916066] \\
V^{145} &= [61.4891384764.870442265.0866554969.1401030547.04065553] \\
V^{146} &= [61.490558664.8718623365.0880756369.1415231847.04207567] \\
V^{147} &= [61.4919077364.8732114665.0894247569.1428723147.04342479] \\
V^{148} &= [61.493189464.8744931365.0907064269.1441539847.04470646] \\
V^{149} &= [61.4944069864.8757107265.0919240169.1453715647.04592405]
\end{aligned}$$

$V^{150} = [61.4955636964.8768674265.0930807169.1465282747.04708075]$
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 $V^{198} = [61.5156673864.8969711165.113184469.1666319647.06718444]$

$9.861805266098145e-05 \leq 0.0001$

Policy is to select b at S1.

MDP: $p_s = 0.2, p_r = 0.03$

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 $V^3 = [18.2499223226.4623499626.800609424.540719562.44144305]$
 $V^4 = [24.6482636623.6787933622.8985437327.935051945.83562068]$
 $V^5 = [22.5869533725.7296102225.4299972833.7280953611.62864939]$
 $V^6 = [24.144577330.5219784230.6235370732.5160141910.41656682]$
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 $V^8 = [28.7925030231.4339584331.0692250437.5523147915.45286728]$
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 $V^{11} = [33.4896572636.3582120236.0208327941.3342687619.23482125]$
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 $V^{13} = [36.0208393139.6271133639.3819481743.3421985421.24275102]$
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 $V^{162} = [60.2491533363.7731781463.5177317967.9695497945.87010227]$
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 $V^{164} = [60.2502912463.7743160563.518869767.970687745.87124018]$
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 $V^{196} = [60.2587838563.7828086663.5273623167.979180345.87973279]$
 $V^{197} = [60.2588858763.7829106763.5274643267.9792823245.87983481]$
 $V^{198} = [60.2589827863.7830075963.5275612467.9793792445.87993172]$

$9.691688817525801e-05 \leq 0.0001$

Policy is to select a at S1.

MDP: $p_s = 0.2, p_r = 0.018985$

$V^0 = [13.4998386722.5998207523.1891057512.44998207 - 9.45001793]$
 $V^1 = [21.1091700913.7559523212.452716822.725110360.64461036]$
 $V^2 = [13.7667103919.8847148220.2147390830.207225918.10957841]$
 $V^3 = [18.591439426.7355875127.3490307224.640223852.54094733]$
 $V^4 = [25.1496080123.8063317523.2669722828.236501956.13707068]$
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 $V^6 = [24.3760620730.9176501831.295551232.6934119210.59396455]$
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 $V^8 = [29.0287264431.6370853331.5265526738.0827796415.98333213]$
 $V^9 = [29.8074369734.9539587435.1572189938.4374251716.33797766]$
 $V^{10} = [32.8911287435.8536952935.8053542239.13691417.03746648]$
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 $V^{14} = [37.6086516540.6764738340.6206106945.3276425923.22819507]$
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 $V^{16} = [39.737627743.3244899343.336495947.2041267225.1046792]$
 $V^{17} = [40.8277786344.1067893944.0779153448.4600637226.36061621]$
 $V^{18} = [41.589943945.2099384145.2221763349.5114567827.41200927]$
 $V^{19} = [42.6160054346.2185954546.2298221950.2629904328.16354291]$
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 $V^{24} = [46.6081947950.1216984850.120546554.3657810332.26633351]$
 $V^{25} = [47.2818307150.8411162950.8456145855.0147557432.91530823]$
 $V^{26} = [47.9647743951.4710264651.4693694455.6523670533.55291954]$
 $V^{27} = [48.5643811952.0752939952.0737838256.2968569734.19740946]$
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 $V^{48} = [56.2780406259.8019401359.8020206263.998184241.89873669]$
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$$\begin{aligned}
V^{101} &= [59.9985383463.5225062863.5225924367.7189071245.61945961] \\
V^{102} &= [60.0116776763.5356456163.5357317667.7320464645.63259894] \\
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V^{113} &= [60.1193255663.643293563.6433796667.8396943545.74024684] \\
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V^{115} &= [60.1331705163.6571384463.657224667.8535392945.75409178] \\
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V^{117} &= [60.1456655763.669633563.6697196667.8660343545.76658684] \\
V^{118} &= [60.1514485463.6754164763.6755026367.8718173245.77236981] \\
V^{119} &= [60.1569423663.680910363.6809964567.8773111445.77786363] \\
V^{120} &= [60.1621614963.6861294363.6862155867.8825302745.78308276] \\
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V^{123} &= [60.1763046863.7002726263.7003587767.8966734745.79722595] \\
V^{124} &= [60.1805556963.7045236363.7046097967.9009244845.80147697] \\
V^{125} &= [60.1845941663.708562163.7086482567.9049629445.80551543] \\
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\end{aligned}$$

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 $V^{181} = [60.2569849563.7809528963.7810390467.9773537445.87790622]$
 $V^{182} = [60.2572019563.7811698963.7812560467.9775707445.87812322]$
 $V^{183} = [60.257408163.7813760463.7814621967.9777768945.87832938]$
 $V^{184} = [60.2576039563.7815718863.7816580467.9779727345.87852522]$
 $V^{185} = [60.2577963.7817579363.7818440967.9781587845.87871127]$
 $V^{186} = [60.2579667563.7819346863.7820208467.9783355345.87888802]$
 $V^{187} = [60.2581346663.7821025963.7821887567.9785034445.87905593]$
 $V^{188} = [60.2582941763.7822621163.7823482667.9786629645.87921545]$
 $V^{189} = [60.2584457163.7824136563.782499867.978814545.87936699]$
 $V^{190} = [60.2585896863.7825576163.7826437767.9789584645.87951095]$
 $V^{191} = [60.2587264463.7826943863.7827805367.9790952345.87964771]$
 $V^{192} = [60.2588563763.782824363.7829104667.9792251545.87977764]$
 $V^{193} = [60.258979863.7829477363.7830338967.9793485845.87990107]$
 $V^{194} = [60.2590970663.7830649963.7831511567.9794658445.88001833]$
 $V^{195} = [60.2592084563.7831763963.7832625467.9795772445.88012972]$
 $V^{196} = [60.2593142863.7832822163.7833683767.9796830645.88023555]$
 $V^{197} = [60.2594148163.7833827563.783468967.979783645.88033608]$
 $V^{198} = [60.2595103263.7834782663.7835644167.9798791145.88043159]$

$9.550791834556094e-05 \leq 0.0001$

Policy is to select Indifferent at S1.

MDP: $p_s = 0.6, p_r = 0.1$

$$\begin{aligned}
V^0 &= [8.9347513.727516.577511.94275 - 9.95725] \\
V^1 &= [15.0225637512.362929.7054137518.7737725 - 3.3067275] \\
V^2 &= [11.9974401614.1808979514.8759422924.627800392.53015289] \\
V^3 &= [13.8586874817.4416759820.3707073422.597452370.49817586] \\
V^4 &= [18.7335300918.5287872119.1566077123.995935771.8965045] \\
V^5 &= [18.1585849519.679864320.2369568428.296782126.19733615] \\
V^6 &= [19.0276636721.9702998624.0168122528.213784436.11433706] \\
V^7 &= [22.3420025223.24430924.3049353528.948961966.84951446] \\
V^8 &= [22.9032099724.2498616824.9608838231.852563549.75311603] \\
V^9 &= [23.5173606125.926395327.5057782832.6082380610.50879054] \\
V^{10} &= [25.7515896927.1691757828.3936449633.2051259411.10567843] \\
V^{11} &= [26.7229674628.1043780528.9883314435.1720961513.07264863] \\
V^{12} &= [27.3237052929.3848920330.7265861836.1894863114.0900388] \\
V^{13} &= [28.8669831830.5013932531.7615889736.7997692214.70032171] \\
V^{14} &= [29.8985219731.3697064632.3817061238.177248716.07780118] \\
V^{15} &= [30.5267183232.3880871933.618362239.1900749117.0906274] \\
V^{16} &= [31.6437379333.3534381634.6018109539.8234012817.72395377] \\
V^{17} &= [32.5907034634.1443522435.2367326240.8386190518.73917153] \\
V^{18} &= [33.2235232234.9809560236.1650613741.7447202719.64527276] \\
V^{19} &= [34.0773621835.8021386337.0279691542.3718607820.27241327] \\
V^{20} &= [34.8962630336.5085261237.6461505243.1614714421.06202392] \\
V^{21} &= [35.5026036837.2112190338.3799948643.9366446821.83719716] \\
V^{22} &= [36.1876429637.9063198239.112483244.5287073922.42925988] \\
V^{23} &= [36.8789992138.5275111139.6882832145.1706619323.07121442] \\
V^{24} &= [37.4369870739.1255328740.2918553445.8227572123.7233097] \\
V^{25} &= [38.0060500939.7142014740.9067361646.3617858824.26233837] \\
V^{26} &= [38.5858341740.2545734741.4260193546.8995424924.80009497] \\
V^{27} &= [39.0849007940.7669330341.9351331547.4463447625.34689724] \\
V^{28} &= [39.5676044241.2667628342.451014947.9249929325.82554541] \\
V^{29} &= [40.0545401641.7335521342.9092678548.3831761126.28372859] \\
V^{30} &= [40.4926053342.1737316343.344548548.8430335726.74358605] \\
V^{31} &= [40.9063864842.5993797943.7790782949.2612657527.16181823] \\
V^{32} &= [41.3172186643.0009274644.1779471449.6547806827.55533317] \\
V^{33} &= [41.6972805843.3793453144.5522949550.0434261227.9439786] \\
V^{34} &= [42.0534538443.7427287544.9201498450.4053003728.30585286] \\
V^{35} &= [42.4018062244.0873695345.2644985450.7442065628.64475905] \\
V^{36} &= [42.7293178444.4125991345.5869764651.0742439428.97479643] \\
V^{37} &= [43.0361500744.723394245.8997938251.3856199329.28617242] \\
V^{38} &= [43.3327579845.0188702746.1957379451.677542229.57809469] \\
V^{39} &= [43.6139679545.2982220946.4734461751.9588745829.85942706] \\
V^{40} &= [43.8781234345.5643589346.7403676452.2260356830.12658816] \\
V^{41} &= [44.1314360645.8175781546.9941479252.4772689230.37782141] \\
V^{42} &= [44.3724828946.0573817447.2330614752.7177183830.61827086] \\
V^{43} &= [44.5996534346.2854405747.4613425452.9466561230.84720861] \\
V^{44} &= [44.8164149446.5024304547.6787710153.1626360131.0631885] \\
V^{45} &= [45.0229086346.7081870447.8840895253.368485231.26903769] \\
V^{46} &= [45.2180728646.9036909948.0795958453.5645929831.46514546] \\
V^{47} &= [45.4037713647.089649248.2658410853.7500886331.65064112] \\
V^{48} &= [45.5806524147.2661337248.4421331753.9264829331.82703542] \\
V^{49} &= [45.7481858447.4337597448.6096980554.0944736931.99502617] \\
V^{50} &= [45.9073694847.5931430548.769248854.2536738932.15422638]
\end{aligned}$$

$V^{51} = [46.0589078347.7444876248.920522354.4048999332.30545241]$
 $V^{52} = [46.2026428147.8882199149.0641915454.5488316932.44938417]$
 $V^{53} = [46.3391348448.0248413949.2009017754.6853986132.5859511]$
 $V^{54} = [46.4689888348.1546110749.3306539754.8150731532.71562564]$
 $V^{55} = [46.5922630848.2778561149.4538521654.938417432.83896988]$
 $V^{56} = [46.7093085948.3949765949.5710153155.0555345932.95608707]$
 $V^{57} = [46.8206024148.506239849.6822810155.1667346333.06728712]$
 $V^{58} = [46.926307548.6119158549.7879272955.2724548533.17300734]$
 $V^{59} = [47.0266770548.7123248749.8883544855.3728761233.27342861]$
 $V^{60} = [47.122077448.807718149.9837552455.4682321133.36878459]$
 $V^{61} = [47.2127080948.8983275250.0743476855.5588582233.45941071]$
 $V^{62} = [47.2987745448.9844128150.160439355.6449569433.54550943]$
 $V^{63} = [47.3805591849.0661989450.2422324155.7267231433.62727563]$
 $V^{64} = [47.4582618349.1438881950.3199128555.804416833.70496928]$
 $V^{65} = [47.5320603649.2176946550.3937205755.8782334633.77878595]$
 $V^{66} = [47.6021768249.2878146750.4638455555.9483437933.84889627]$
 $V^{67} = [47.6687947449.35442550.5304517556.0149538433.91550633]$
 $V^{68} = [47.7320717549.4177047150.5937309456.0782401233.97879261]$
 $V^{69} = [47.7921867749.4778229350.6538522356.1383541634.03890664]$
 $V^{70} = [47.849301449.5349336550.7109612556.1954633334.09601582]$
 $V^{71} = [47.903555549.5891882550.7652149556.2497217134.1502742]$
 $V^{72} = [47.9550965649.6407315550.8167599756.3012635234.201816]$
 $V^{73} = [48.0040639549.6896971250.8657249956.3502275934.25078008]$
 $V^{74} = [48.0505809449.7362138450.9122409556.396746334.29729878]$
 $V^{75} = [48.094771249.7804054850.9564334656.440937634.34149009]$
 $V^{76} = [48.1367538749.8223874150.9984153256.4829184534.38347094]$
 $V^{77} = [48.1766367149.8622698451.0382972256.5228018134.4233543]$
 $V^{78} = [48.2145246149.900158551.0761862756.5606905634.46124305]$
 $V^{79} = [48.250519149.9361527651.1121806156.5966841434.49723663]$
 $V^{80} = [48.2847137449.9703470551.1463745956.6308788234.53143131]$
 $V^{81} = [48.3171980850.0028317751.1788594756.6633637334.56391622]$
 $V^{82} = [48.3480586650.0336923351.2097201356.6942239134.5947764]$
 $V^{83} = [48.3773762850.0630097151.2390373456.7235414334.62409391]$
 $V^{84} = [48.4052276750.0908612851.2668889556.7513931634.65194564]$
 $V^{85} = [48.4316866850.1173203351.2933480956.7778520134.6784045]$
 $V^{86} = [48.4568228550.1424563551.3184840256.8029880634.70354054]$
 $V^{87} = [48.4807020150.1663355851.3423632656.826867434.72741989]$
 $V^{88} = [48.5033872850.1890208951.3650486256.8495526234.75010511]$
 $V^{89} = [48.5249383650.2105719151.386599656.8711036234.77165611]$
 $V^{90} = [48.545411850.2310453651.4070730456.8915771534.79212963]$
 $V^{91} = [48.5648615750.2504951751.4265228856.9110269234.8115794]$
 $V^{92} = [48.5833389250.2689724851.4450001856.929504234.83005669]$
 $V^{93} = [48.6008923550.2865259151.462553656.9470576734.84761016]$
 $V^{94} = [48.617568150.3032016851.4792293956.9637334434.86428592]$
 $V^{95} = [48.633410150.3190436651.4950713756.979575434.88012789]$
 $V^{96} = [48.6484599850.3340935451.5101212356.9946252934.89517778]$
 $V^{97} = [48.6627573550.3483909351.5244186357.0089226834.90947517]$
 $V^{98} = [48.6763398850.3619734551.5380011557.0225051934.92305768]$
 $V^{99} = [48.6892432750.3748768451.5509045357.0354085934.93596107]$
 $V^{100} = [48.7015014950.3871350651.5631627657.0476668134.9482193]$
 $V^{101} = [48.713146850.3987803751.5748080757.0593121234.9598646]$

$$\begin{aligned}
V^{102} &= [48.7242098550.4098434251.5858711157.0703751734.97092765] \\
V^{103} &= [48.7347197450.4203533151.5963810157.0808850634.98143755] \\
V^{104} &= [48.7447041450.4303377151.6063654157.0908694634.99142194] \\
V^{105} &= [48.7541893250.4398228951.6158505957.1003546435.00090712] \\
V^{106} &= [48.7632002450.4488338151.6248615157.1093655635.00991804] \\
V^{107} &= [48.7717606150.4573941851.6334218857.1179259335.01847842] \\
V^{108} &= [48.7798929750.4655265451.6415542357.1260582835.02661077] \\
V^{109} &= [48.787618750.4732522751.6492799757.1337840235.03433651] \\
V^{110} &= [48.7949581550.4805917351.6566194257.1411234735.04167596] \\
V^{111} &= [48.8019306350.487564251.663591957.1480959535.04864844] \\
V^{112} &= [48.8085544950.4941880651.6702157557.1547198135.05527229] \\
V^{113} &= [48.8148471550.5004807251.6765084257.1610124735.06156495] \\
V^{114} &= [48.8208251750.5064587551.6824864457.1669904935.06754298] \\
V^{115} &= [48.826504350.5121378751.6881655757.1726696235.07322211] \\
V^{116} &= [48.8318994750.5175330451.6935607457.1780647935.07861728] \\
V^{117} &= [48.8370248850.5226584651.6986861557.183190235.08374269] \\
V^{118} &= [48.8418940350.527527651.7035552957.1880593535.08861183] \\
V^{119} &= [48.8465197150.5321532851.7081809857.1926850335.09323752] \\
V^{120} &= [48.8509141150.5365476851.7125753857.1970794335.09763192] \\
V^{121} &= [48.8550887950.5407223651.7167500657.2012541135.1018066] \\
V^{122} &= [48.8590547450.5446883151.7207160157.2052200635.10577254] \\
V^{123} &= [48.8628223850.5484559651.7244836557.208987735.10954019] \\
V^{124} &= [48.8664016550.5520352251.7280629257.2125669735.11311946] \\
V^{125} &= [48.8698019550.5554355351.7314632257.2159672735.11651976] \\
V^{126} &= [48.8730322450.5586658151.7346935157.2191975635.11975005] \\
V^{127} &= [48.8761010250.5617345951.7377622957.2222663435.12281882] \\
V^{128} &= [48.8790163550.5646499251.7406776257.2251816735.12573416] \\
V^{129} &= [48.8817859250.5674194951.7434471957.2279512435.12850372] \\
V^{130} &= [48.8844170150.5700505851.7460782857.2305823335.13113481] \\
V^{131} &= [48.8869165450.5725501251.7485778157.2330818635.13363435] \\
V^{132} &= [48.889291150.5749246751.7509523757.2354564235.13600891] \\
V^{133} &= [48.8915469350.577180551.753208257.2377122535.13826474] \\
V^{134} &= [48.8936899750.5793235451.7553512457.2398552935.14040778] \\
V^{135} &= [48.8957258650.5813594351.7573871357.2418911835.14244366] \\
V^{136} &= [48.8976599550.5832935251.7593212257.2438252735.14437776] \\
V^{137} &= [48.8994973450.5851309151.7611586157.2456626635.14621514] \\
V^{138} &= [48.9012428650.5868764351.7629041357.2474081835.14796066] \\
V^{139} &= [48.902901150.5885346751.7645623757.2490664235.14961891] \\
V^{140} &= [48.9044764350.5901151.766137757.2506417535.15119424] \\
V^{141} &= [48.9059729950.5916065751.7676342657.2521383135.1526908] \\
V^{142} &= [48.9073947350.593028351.76905657.2535600535.15411254] \\
V^{143} &= [48.9087453850.5943789551.7704066557.254910735.15546319] \\
V^{144} &= [48.910028550.5956620751.7716897757.2561938235.1567463] \\
V^{145} &= [48.9112474650.5968810351.7729087357.2574127835.15796526] \\
V^{146} &= [48.9124054750.5980390451.7740667457.2585707935.15912328] \\
V^{147} &= [48.9135055850.5991391551.7751668557.259670935.16022339] \\
V^{148} &= [48.9145506950.6001842651.7762119657.2607160135.16126849] \\
V^{149} &= [48.9155435450.6011771151.7772048157.2617088635.16226135] \\
V^{150} &= [48.9164867550.6021203251.7781480257.2626520735.16320455] \\
V^{151} &= [48.917382850.6030163751.7790440757.2635481235.1641006] \\
V^{152} &= [48.9182340450.6038676151.7798953157.2643993635.16495185]
\end{aligned}$$

$V^{153} = [48.9190427350.604676351.78070457.2652080535.16576053]$
 $V^{154} = [48.9198109750.6054445551.7814722457.2659762935.16652878]$
 $V^{155} = [48.9205408150.6061743851.7822020857.2667061335.16725862]$
 $V^{156} = [48.9212341650.6068677351.7828954357.2673994835.16795196]$
 $V^{157} = [48.9218928350.6075264151.783554157.2680581535.16861064]$
 $V^{158} = [48.9225185850.6081521551.7841798557.268683935.16923638]$
 $V^{159} = [48.9231130350.6087466151.784774357.2692783535.16983084]$
 $V^{160} = [48.9236777750.6093113451.7853390457.2698430935.17039557]$
 $V^{161} = [48.9242142750.6098478451.7858755457.2703795935.17093207]$
 $V^{162} = [48.9247239450.6103575151.7863852157.2708892635.17144174]$
 $V^{163} = [48.9252081350.610841751.786869457.2713734535.17192593]$
 $V^{164} = [48.9256681150.6113016851.7873293857.2718334335.17238591]$
 $V^{165} = [48.9261050950.6117386651.7877663657.2722704135.17282289]$
 $V^{166} = [48.9265202250.6121537951.7881814957.2726855435.17323802]$
 $V^{167} = [48.9269145950.6125481651.7885758657.2730799135.1736324]$
 $V^{168} = [48.9272892550.6129228251.7889505257.2734545735.17400705]$
 $V^{169} = [48.9276451750.6132787451.7893064457.2738104935.17436298]$
 $V^{170} = [48.927983350.6136168751.7896445757.2741486235.1747011]$
 $V^{171} = [48.9283045250.6139380951.7899657957.2744698435.17502232]$
 $V^{172} = [48.9286096850.6142432551.7902709557.27477535.17532748]$
 $V^{173} = [48.9288995850.6145331551.7905608557.275064935.17561739]$
 $V^{174} = [48.9291749950.6148085651.7908362657.2753403135.17589279]$
 $V^{175} = [48.9294366250.615070251.7910978957.2756019435.17615443]$
 $V^{176} = [48.9296851850.6153187551.7913464557.275850535.17640298]$
 $V^{177} = [48.929921350.6155548851.7915825757.2760866235.17663911]$
 $V^{178} = [48.9301456250.615779251.7918068957.2763109435.17686343]$
 $V^{179} = [48.9303587350.615992351.7920257.2765240535.17707653]$
 $V^{180} = [48.9305611850.6161947551.7922224557.276726535.17727898]$
 $V^{181} = [48.930753550.6163870851.7924147757.2769188235.17747131]$
 $V^{182} = [48.9309362150.6165697951.7925974857.2771015335.17765402]$
 $V^{183} = [48.9311097950.6167433651.7927710657.2772751135.1778276]$
 $V^{184} = [48.9312746950.6169082651.7929359657.2774400135.17799249]$
 $V^{185} = [48.9314313450.6170649151.7930926157.2775966635.17814914]$
 $V^{186} = [48.9315801650.6172137351.7932414357.2777454835.17829796]$
 $V^{187} = [48.9317215350.6173551151.793382857.2778868535.17843934]$
 $V^{188} = [48.9318558450.6174894151.7935171157.2780211635.17857365]$
 $V^{189} = [48.9319834450.6176170151.7936447157.2781487635.17870124]$
 $V^{190} = [48.9321046550.6177382251.7937659257.2782699735.17882246]$
 $V^{191} = [48.932219850.6178533751.7938810757.2783851235.17893761]$
 $V^{192} = [48.932329250.6179627751.7939904757.2784945235.179047]$
 $V^{193} = [48.9324331250.618066751.7940943957.2785984435.17915093]$
 $V^{194} = [48.9325318550.6181654351.7941931257.2786971735.17924966]$

$9.872937464905363e-05 \leq 0.0001$

Policy is to select b at S1.

MDP: $p_s = 0.6, p_r = 0.2$

$V^0 = [7.3102511.922512.872511.76225 - 10.13775]$
 $V^1 = [11.7004612511.265487.1186112517.3676775 - 4.7128225]$
 $V^2 = [10.7435292213.0210410511.3303373321.65382373 - 0.44382377]$
 $V^3 = [12.1536253715.6504464215.3918483121.24283074 - 0.85644578]$
 $V^4 = [14.535726116.9930301415.4259833322.409418610.30998735]$

$V^5 = [15.9099347518.2016062516.4266293924.556940582.45749461]$
 $V^6 = [17.0738171519.7065529818.3578192525.935903563.8364562]$
 $V^7 = [18.4711154321.0883785619.7202953827.06202454.962577]$
 $V^8 = [19.7853196322.3039450920.8125639828.363696026.26424851]$
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$9.525875846350118e-05 \leq 0.0001$

Policy is to select a at S1.

MDP: $p_s = 0.6, p_r = 0.13762$

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 $V^4 = [17.0359212717.951035417.7531468223.082138480.98270721]$
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 $V^{36} = [38.2984257540.8523639140.8523547446.9351369724.83568945]$
 $V^{37} = [38.5671215941.1211994841.1212561447.2039920325.10454451]$
 $V^{38} = [38.8225505541.3766006741.3766728547.459268225.35982069]$
 $V^{39} = [39.0651975941.619184341.6191985647.701911225.60246368]$
 $V^{40} = [39.2956085441.8496613141.8496982747.932425525.83297799]$
 $V^{41} = [39.5145748342.0686286342.0686854748.1513257326.05187821]$
 $V^{42} = [39.7226106942.276622142.2766489548.3593374326.25988991]$
 $V^{43} = [39.9201828742.4742228242.4742554848.5569691926.45752168]$
 $V^{44} = [40.1079058142.661955342.6620032648.7446684226.64522091]$
 $V^{45} = [40.2862638442.8402885242.8403221448.9230029726.82355545]$
 $V^{46} = [40.455670543.0097055843.0097384749.0924408626.99299335]$
 $V^{47} = [40.6166150943.1706597143.1707024349.2533801627.15393264]$
 $V^{48} = [40.7695290143.323560543.323597149.4062770227.3068295]$
 $V^{49} = [40.9147807743.4688147543.468848949.5515436227.4520961]$
 $V^{50} = [41.0527699943.6068109843.6068507749.689534227.59008669]$
 $V^{51} = [41.1838705643.7379052643.737942949.8206240927.72117657]$
 $V^{52} = [41.3084088843.8624431543.862478549.9451686227.8457211]$
 $V^{53} = [41.4267179643.9807566743.9807949650.0634806127.9640331]$
 $V^{54} = [41.5391178944.0931539344.0931917850.1758745228.076427]$
 $V^{55} = [41.6458951744.1999300644.1999662650.2826538828.18320636]$
 $V^{56} = [41.747331244.3013686144.3014061950.3840924928.28464497]$
 $V^{57} = [41.8436987644.3977352544.39777350.4804569628.38100944]$
 $V^{58} = [41.9352472944.4892827444.4893194750.5720058528.47255834]$
 $V^{59} = [42.0222166444.5762533844.5762906850.6589769928.55952948]$
 $V^{60} = [42.1048391144.6588756944.6589132750.7415980428.64215052]$
 $V^{61} = [42.1833305744.7373663944.7374034150.8200892628.72064174]$

$$\begin{aligned}
V^{62} &= [42.2578963244.8119327644.8119699750.8946561128.7952086] \\
V^{63} &= [42.3287344744.88277144.8828084550.9654936928.86604617] \\
V^{64} &= [42.39603144.9500670744.9501042451.0327898828.93334236] \\
V^{65} &= [42.4599620745.0139983845.0140355851.0967215528.99727403] \\
V^{66} &= [42.5206968245.0747332745.0747706351.1574561229.0580086] \\
V^{67} &= [42.5783950945.1324312945.1324685251.2151541129.11570659] \\
V^{68} &= [42.6332081245.1872443945.187281651.2699674429.17051993] \\
V^{69} &= [42.6852805445.2393169345.2393542551.3220398529.22259233] \\
V^{70} &= [42.7347495345.2887857945.2888230651.3715086529.27206114] \\
V^{71} &= [42.7817449245.3357811945.3358184251.4185041729.31905666] \\
V^{72} &= [42.8263905145.3804268645.3804641551.463149829.36370229] \\
V^{73} &= [42.8688039545.4228402445.4228775151.5055631229.40611561] \\
V^{74} &= [42.9090966445.4631329245.4631701651.5458558729.44640836] \\
V^{75} &= [42.9473746745.501411145.5014482751.5841339429.48468642] \\
V^{76} &= [42.9837388645.5377751645.5378124351.6204980729.52105055] \\
V^{77} &= [43.0182848245.5723211145.5723583651.6550440429.55559653] \\
V^{78} &= [43.0511034645.6051397745.6051770351.6878627129.58841519] \\
V^{79} &= [43.0822811945.636317545.6363547651.7190404129.6195929] \\
V^{80} &= [43.1119000445.6659363345.6659735951.7486592629.64921174] \\
V^{81} &= [43.1400379245.6940742345.6941114951.7767971629.67734965] \\
V^{82} &= [43.1667689245.7208052345.7208424951.8035281529.70408064] \\
V^{83} &= [43.1921633845.7461996845.7462369451.828922629.72947509] \\
V^{84} &= [43.216288145.7703244145.7703616751.8530473429.75359982] \\
V^{85} &= [43.2392065945.793242945.7932801651.8759658329.77651831] \\
V^{86} &= [43.2609791745.8150154745.8150527351.8977383929.79829088] \\
V^{87} &= [43.281663145.835699445.8357366751.9184223329.81897482] \\
V^{88} &= [43.3013128445.8553491545.8553864151.9380720729.83862456] \\
V^{89} &= [43.319980145.874016445.8740536651.9567393329.85729181] \\
V^{90} &= [43.3377139945.8917502945.8917875651.9744732229.87502571] \\
V^{91} &= [43.3545611945.9085974945.9086347551.9913204229.89187291] \\
V^{92} &= [43.3705660345.9246023345.9246395952.0073252629.90787774] \\
V^{93} &= [43.3857706245.9398069345.9398441952.0225298529.92308234] \\
V^{94} &= [43.4002149945.9542512945.9542885552.0369742229.93752671] \\
V^{95} &= [43.4139371445.9679734445.968010752.0506963729.95124885] \\
V^{96} &= [43.4269731845.9810094845.9810467452.0637324129.96428489] \\
V^{97} &= [43.4393574245.9933937245.9934309852.0761166529.97666913] \\
V^{98} &= [43.4511224446.0051587546.0051960152.0878816729.98843416] \\
V^{99} &= [43.4622992246.0163355246.0163727852.0990584529.99961093] \\
V^{100} &= [43.4729171546.0269534646.0269907252.1096763830.01022887] \\
V^{101} &= [43.4830041946.037040546.0370777652.1197634230.02031591] \\
V^{102} &= [43.4925868846.0466231846.0466604552.1293461130.0298986] \\
V^{103} &= [43.5016904346.0557267446.05576452.1384496630.03900215] \\
V^{104} &= [43.5103388146.0643751146.0644123752.1470980430.04765053] \\
V^{105} &= [43.5185547746.0725910746.0726283352.15531430.05586648] \\
V^{106} &= [43.5263599346.0803962346.0804334952.1631191630.06367164] \\
V^{107} &= [43.5337748346.0878111346.0878483952.1705340630.07108654] \\
V^{108} &= [43.5408189846.0948552946.0948925552.1775782130.0781307] \\
V^{109} &= [43.5475109346.1015472346.1015844952.1842701630.08482265] \\
V^{110} &= [43.5538682846.1079045846.1079418552.1906275130.09118] \\
V^{111} &= [43.5599077646.1139440746.1139813352.1966669930.09721948] \\
V^{112} &= [43.5656452746.1196815846.1197188452.202404530.10295699]
\end{aligned}$$

$$\begin{aligned}
V^{113} &= [43.5710959146.1251322146.1251694752.2078551430.10840762] \\
V^{114} &= [43.5762740146.1303103146.1303475752.2130332430.11358573] \\
V^{115} &= [43.5811932146.1352295146.1352667752.2179524430.11850492] \\
V^{116} &= [43.5858664446.1399027546.1399400152.2226256730.12317816] \\
V^{117} &= [43.5903060246.1443423246.1443795852.2270652530.12761773] \\
V^{118} &= [43.5945236146.1485599246.1485971852.2312828430.13183533] \\
V^{119} &= [43.5985303346.1525666346.152603952.2352895630.13584205] \\
V^{120} &= [43.6023367146.1563730146.1564102852.2390959430.13964843] \\
V^{121} &= [43.6059527746.1599890846.1600263452.24271230.14326449] \\
V^{122} &= [43.6093880346.1634243346.163461652.2461472630.14669975] \\
V^{123} &= [43.6126515346.1666878346.1667250952.2494107630.14996324] \\
V^{124} &= [43.6157518546.1697881546.1698254152.2525110830.15306356] \\
V^{125} &= [43.6186971546.1727334646.1727707252.2554563830.15600887] \\
V^{126} &= [43.6214951946.175531546.1755687652.2582544230.15880691] \\
V^{127} &= [43.6241533346.1781896346.1782268952.2609125630.16146505] \\
V^{128} &= [43.6266785646.1807148646.1807521352.2634377930.16399028] \\
V^{129} &= [43.6290775346.1831138346.1831510952.2658367630.16638925] \\
V^{130} &= [43.6313565546.1853928546.1854301252.2681157830.16866827] \\
V^{131} &= [43.6335216246.1875579246.1875951952.2702808530.17083334] \\
V^{132} &= [43.6355784446.1896147446.18965252.2723376730.17289015] \\
V^{133} &= [43.6375324146.1915687146.1916059852.2742916430.17484413] \\
V^{134} &= [43.6393886946.1934249946.1934622552.2761479230.17670041] \\
V^{135} &= [43.6411521546.1951884546.1952257252.2779113830.17846387] \\
V^{136} &= [43.6428274446.1968637446.1969010152.2795866730.18013916] \\
V^{137} &= [43.6444189746.1984552746.1984925352.281178230.18173068] \\
V^{138} &= [43.6459309246.1999672246.2000044852.2826901530.18324263] \\
V^{139} &= [43.6473672746.2014035746.2014408352.284126530.18467898] \\
V^{140} &= [43.648731846.202768146.2028053752.2854910330.18604352] \\
V^{141} &= [43.6500281146.2040644146.2041016752.2867873430.18733982] \\
V^{142} &= [43.651259646.205295946.2053331652.2880188330.18857132] \\
V^{143} &= [43.6524295246.2064658246.2065030852.2891887530.18974123] \\
V^{144} &= [43.6535409446.2075772446.207614552.2903001730.19085265] \\
V^{145} &= [43.6545967946.2086330946.2086703552.2913560230.19190851] \\
V^{146} &= [43.6555998546.2096361546.2096734152.2923590830.19291156] \\
V^{147} &= [43.6565527546.2105890546.2106263252.2933119830.19386447] \\
V^{148} &= [43.6574580146.2114943146.2115315852.2942172430.19476973] \\
V^{149} &= [43.6583180146.2123543146.2123915752.2950772430.19562972] \\
V^{150} &= [43.6591350146.2131713146.2132085752.2958942330.19644672] \\
V^{151} &= [43.6599111546.2139474546.2139847252.2966703830.19722287] \\
V^{152} &= [43.6606484946.2146847946.2147220652.2974077230.19796021] \\
V^{153} &= [43.6613489646.2153852746.2154225352.2981081930.19866068] \\
V^{154} &= [43.6620144146.2160507246.2160879852.2987736430.19932613] \\
V^{155} &= [43.6626465946.2166828946.2167201552.2994058230.19995831] \\
V^{156} &= [43.6632471646.2172834646.2173207252.3000063930.20055887] \\
V^{157} &= [43.663817746.21785446.2178912652.3005769330.20112941] \\
V^{158} &= [43.6643597146.2183960146.2184332752.3011189430.20167143] \\
V^{159} &= [43.6648746246.2189109246.2189481952.3016338530.20218634] \\
V^{160} &= [43.6653637946.2194000946.2194373552.3021230230.2026755] \\
V^{161} &= [43.665828546.219864846.2199020652.3025877330.20314021] \\
V^{162} &= [43.6662699746.2203062746.2203435352.303029230.20358168] \\
V^{163} &= [43.6666893746.2207256746.2207629352.303448630.20400108]
\end{aligned}$$

$V^{164} = [43.667087846.221124146.2211613652.3038470330.20439951]$
 $V^{165} = [43.667466346.2215026146.2215398752.3042255330.20477802]$
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 $V^{167} = [43.6681674946.2222037946.2222410552.3049267230.2054792]$
 $V^{168} = [43.6684920146.2225283146.2225655852.3052512430.20580373]$
 $V^{169} = [43.6688003146.2228366146.2228738752.3055595430.20611202]$
 $V^{170} = [43.6690931946.2231294946.2231667552.3058524230.20640491]$
 $V^{171} = [43.6693714346.2234077346.2234449952.3061306630.20668314]$
 $V^{172} = [43.6696357546.2236720646.2237093252.3063949830.20694747]$
 $V^{173} = [43.6698868646.2239231746.2239604352.3066460930.20719858]$
 $V^{174} = [43.6701254246.2241617246.2241989852.3068846530.20743713]$
 $V^{175} = [43.6703520446.2243883546.2244256152.3071112730.20766376]$
 $V^{176} = [43.6705673446.2246036446.224640952.3073265730.20787905]$
 $V^{177} = [43.6707718746.2248081746.2248454352.307531130.20808358]$
 $V^{178} = [43.6709661746.2250024846.2250397452.307725430.20827789]$
 $V^{179} = [43.6711507646.2251870646.2252243352.3079099930.20846248]$
 $V^{180} = [43.6713261246.2253624246.2253996852.3080853530.20863784]$
 $V^{181} = [43.6714927146.2255290146.2255662852.3082519430.20880443]$
 $V^{182} = [43.6716509746.2256872846.2257245452.308410230.20896269]$
 $V^{183} = [43.6718013246.2258376246.2258748952.3085605530.20911304]$
 $V^{184} = [43.6719441546.2259804646.2260177252.3087033830.20925587]$
 $V^{185} = [43.6720798446.2261161546.2261534152.3088390730.20939156]$
 $V^{186} = [43.6722087546.2262450546.2262823152.3089679830.20952046]$
 $V^{187} = [43.6723312146.2263675146.2264047752.3090904430.20964292]$
 $V^{188} = [43.6724475446.2264838546.2265211152.3092067730.20975926]$
 $V^{189} = [43.6725580646.2265943746.2266316352.3093172930.20986978]$
 $V^{190} = [43.6726630646.2266993646.2267366252.3094222930.20997477]$
 $V^{191} = [43.672762846.2267991146.2268363752.3095220330.21007452]$

$9.974432593651272e-05 \leq 0.0001$

Policy is to select Indifferent at S1.