Kalle Prorok 2023-01-30

DRL Bridge bidding Inventor

An attempt to learn and use bidding systems.
As an example we used 1 Spade(5+,12-21) – 1 NT (0-2 spades, 8-11).
Learning rates 1e-3, 1e-4, 1e-5, 1e-6, 1e-7 was tried; not much difference but 1e-6 sometimes better.

Experiences;
1. Gamma = 0.95 reduces the future values by this factor and encourages short biddings?
Well, because we compare with par-result and losing imps the results are negative resulting in strange learning.
Solution: Add offset +20 imps to results to keep them positive (+20 corresponds to par-result), subtract 20 when printing/showing to the user.

2. Adding more bids actually got worse performance than just a single rebid (-4 imps/deal); what to do if partner just bid random 3 C or 4D after my rebid ? – better to pass and play in 1 NT.
Solution: Don’t allow Pass as rebid..later: create new examples with excluded hands like (semi)bal 5 sp and 11-13 h.c.p assuming to be passed.

3. Couldn’t solve DA2C-algorithm on GPU.. but worked good on multi-core CPUs and actually faster. Now a run with 2 million trial bids took 15 mins on a 5 yr old i5-8700K with 12 hyperthreaded cores, using 10 and saving 2 for GUI etc.

Examples (Learning rate = 1e-6, two bids, no pass-rebid)

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1♠-Bidding Contract Score Impdiff (Parscore) N[shape,hcp] S[shape,hpc]  N-cards E-cards S-cards W-cards
1N 2♠ 2N -100 -5 ( 110 ) [6, 2, 3, 2, 15] [1, 3, 3, 6, 9]  n AKJ987.A6.K64.T8  e 642.873.AQJ93.32  s T.KQ5.T82.KJ7654  w Q53.JT942.75.AQ9
1N 3♣ 3♠ 170 -6 ( 420 ) [5, 1, 5, 2, 18] [2, 4, 2, 5, 8]  n AQJ84.A.AKT52.63  e 7.862.Q986.KQT54  s K6.K975.J3.J9872  w T9532.QJT43.74.A
1N 2♣ 2N 180 -6 ( 430 ) [5, 3, 3, 2, 15] [2, 2, 5, 4, 8]  n AQJ74.KJT.JT8.K3  e 52.74.9764.A8764  s T9.65.KQ532.QJ92  w K863.AQ9832.A.T5
1N 2♦ 2N 180 -7 ( 450 ) [6, 1, 1, 5, 13] [2, 4, 3, 4, 11]  n AJ9853.K.4.KQT96  e 764.Q62.KJ972.A5  s T2.A975.AQT.J842  w KQ.JT843.8653.73
1N 3♣ 4♣ 190 -15 ( 1440 ) [6, 2, 3, 2, 15] [1, 3, 3, 6, 11]  n AQ9632.AQ.K96.T9  e T874.KJT9854.5.K  s 5.732.A32.AQJ864  w KJ.6.QJT874.7532
1N 2♣ 2♦ 130 -8 ( 450 ) [5, 3, 4, 1, 15] [1, 5, 3, 4, 9]  n AT872.A63.K974.A  e KQ43.T98.63.Q953  s 5.KQJ75.T85.KT74  w J96.42.AQJ2.J862
1N 2N 3♣ 170 -13 ( 920 ) [5, 2, 5, 1, 19] [1, 1, 4, 7, 9]  n AQT53.QJ.AKQJ9.T  e KJ874.A852.T6.J6  s 2.9.8743.AKQ8754  w 96.KT7643.52.932
1N 2♠ 2N 150 -7 ( 430 ) [5, 1, 4, 3, 15] [2, 4, 3, 4, 10]  n AKJ86.9.AK95.654  e T972.J853.74.AJ3  s Q3.KQ76.T62.K987  w 54.AT42.QJ83.QT2
1N 2♦ 2♠ 230 -13 ( 990 ) [5, 3, 1, 4, 20] [2, 4, 5, 2, 9]  n AKT32.KT2.Q.AKJ9  e 965.Q85.A762.875  s J4.AJ97.KT983.32  w Q87.643.J54.QT64
1N 2♠ 3♣ -250 -11 ( 300 ) [5, 5, 2, 1, 12] [2, 5, 2, 4, 11]  n AQT96.KQ954.J9.8  e J543.A7.AT7642.K  s K7.JT832.KQ.Q653  w 82.6.853.AJT9742
1N 2♦ 3♣ 110 -7 ( 420 ) [6, 1, 1, 5, 16] [2, 5, 4, 2, 9]  n AKQ984.K.5.KJ852  e J2.T87.QJ84.QT94  s T6.Q9542.AK97.63  w 753.AJ63.T632.A7
1N 2♣ 2N 150 -6 ( 400 ) [5, 3, 3, 2, 15] [1, 3, 4, 5, 11]  n A8432.K83.A54.KJ  e T.A752.762.98765  s Q.Q64.KQT8.QT432  w KJ9765.JT9.J93.A
1N 2♥ 2N 150 -7 ( 420 ) [5, 3, 4, 1, 16] [1, 5, 4, 3, 11]  n AKT87.K72.KQJ2.7  e J54.QJT4.3.AQ984  s 2.A8653.A864.KT5  w Q963.9.T975.J632
1N 2N 3♣ -50 -14 ( 920 ) [5, 2, 4, 2, 17] [1, 5, 4, 3, 11]  n KQT76.A6.K432.KQ  e 53.KJ5.QT76.T942  s J.T9743.AJ95.AJ8  w A9842.Q82.8.7653
1N 2N 3♥ -250 -8 ( 100 ) [6, 3, 2, 2, 16] [2, 2, 6, 3, 8]  n AKT984.K32.K3.K4  e J652.AJ87.9.AQ93  s 73.65.AQJ765.JT5  w Q.QT94.T842.8762
1N 2♠ 2N -100 -5 ( 110 ) [6, 2, 2, 3, 13] [2, 5, 3, 3, 9]  n K96532.A5.AQ.T42  e J4.KJT8.KJ952.A7  s A7.Q9764.T74.QJ6  w QT8.32.863.K9853
1N 3♣ 3♠ 170 -6 ( 430 ) [5, 3, 1, 4, 17] [2, 4, 4, 3, 9]  n KQT76.K92.8.AKQ5  e AJ2.Q74.AJ732.97  s 53.A865.KQT4.T86  w 984.JT3.965.J432
1N 3♣ 3♥ -100 -5 ( 110 ) [5, 4, 2, 2, 12] [2, 3, 5, 3, 10]  n AQ632.Q873.A2.76  e 84.42.KQT85.J854  s T9.K65.J9743.AQ2  w KJ75.AJT9.6.KT93
1N 3♣ 4♣ -100 -6 ( 120 ) [5, 1, 4, 3, 12] [1, 5, 3, 4, 10]  n K9864.Q.AK42.985  e 2.AJ963.QT9.AJ73  s Q.KT754.875.KQT4  w AJT753.82.J63.62
1N 2♣ 2♠ 140 0 ( 140 ) [5, 2, 4, 2, 12] [2, 4, 4, 3, 10]  n KQT82.Q2.KQ84.43  e J6.K763.972.T762  s 94.AJ54.JT53.A95  w A753.T98.A6.KQJ8
1N 3♣ 4♣ -100 -11 ( 420 ) [5, 1, 3, 4, 14] [2, 6, 4, 1, 11]  n AKQT9.7.Q83.QJT6  e J632.A6.65.AK983  s 74.KJT842.AK42.7  w 85.Q953.JT97.542
1N 3♣ 3N -50 -5 ( 140 ) [5, 2, 4, 2, 14] [1, 5, 4, 3, 9]  n A9754.96.AKQ4.J8  e KQJ6.K5.T9.A7653  s 2.A8732.8652.KQ9  w T83.QJT4.J73.T42
1N 2♠ 2N 210 -6 ( 460 ) [6, 2, 1, 4, 14] [2, 2, 5, 4, 11]  n AK8732.AQ.T.JT64  e T.JT86542..K8753  s Q4.97.QJ542.AQ92  w J965.K3.AK98763.
1N 2♣ 2♠ 110 0 ( 110 ) [5, 4, 3, 1, 12] [2, 1, 4, 6, 10]  n AQT54.J863.AJ4.6  e J9.AKT97.T6.J854  s K3.5.Q752.KQ9732  w 8762.Q42.K983.AT
1N 3♣ 3♦ -50 -10 ( 400 ) [5, 1, 3, 4, 17] [2, 5, 3, 3, 10]  n QJT74.J.AT6.AKQT  e 3.Q7653.Q42.J962  s K5.AKT98.975.874  w A9862.42.KJ83.53
1N 2N 3♠ -150 7 ( -450 ) [5, 2, 4, 2, 14] [2, 2, 5, 4, 11]  n AK853.Q9.KQ32.82  e QT7642.A6542.T.9  s J9.KJ.A9754.QT54  w .T873.J86.AKJ763
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1N 2N 3♦ -100 -5 ( 90 ) [6, 2, 3, 2, 12] [1, 4, 5, 3, 9]  n AT9843.A5.854.A3  e KQ765.T984.2.JT9  s J.K732.QJ976.Q72  w 2.QJ6.AKT3.K8654
1N 3♣ 3♠ -150 -11 ( 430 ) [6, 5, 0, 2, 14] [2, 3, 5, 3, 10]  n AKT984.AK852..32  e 7.J643.J642.AQ94  s J5.T97.KQ873.KJ6  w Q632.Q.AT95.T875
1N 2♣ 2♣ -200 -7 ( 100 ) [5, 4, 2, 2, 13] [1, 5, 4, 3, 8]  n KJ862.AKQ6.97.64  e A.873.AKJT4.AJ72  s 4.JT954.Q852.KQ5  w QT9753.2.63.T983
1N 2N 2N 120 -7 ( 420 ) [5, 1, 3, 4, 16] [2, 6, 1, 4, 8]  n AKQ74.Q.T83.AJ73  e JT6.T84.KJ9654.K  s 95.A76532.A.T842  w 832.KJ9.Q72.Q965
1N 3♣ 3N -150 0 ( -140 ) [5, 0, 5, 3, 12] [2, 4, 2, 5, 8]  n A6542..AKJ53.754  e T.J84.QT9862.AKJ  s K8.KQT3.74.T9862  w QJ973.A97652..Q3
1N 2♣ 2♣ -200 -7 ( 100 ) [6, 2, 3, 2, 12] [1, 3, 6, 3, 8]  n KT8542.A8.KQ7.52  e QJ763.KT42.J4.QT  s A.753.AT8652.943  w 9.QJ96.93.AKJ876
1N 2♥ 3♣ -50 -5 ( 120 ) [5, 3, 2, 3, 16] [2, 4, 3, 4, 8]  n KJ632.A65.K5.KQ6  e 97.J2.98763.9873  s Q8.9843.AJ2.JT52  w AT54.KQT7.QT4.A4
1N 2♣ 2♠ 140 0 ( 140 ) [6, 2, 2, 3, 12] [2, 3, 6, 2, 10]  n KT7653.A9.J6.A92  e QJ4.KJ643.KQ.JT4  s A8.Q52.A97532.53  w 92.T87.T84.KQ876
1N 2♦ 2♦ -100 0 ( -90 ) [5, 1, 4, 3, 14] [2, 5, 2, 4, 8]  n AQ765.Q.7654.AQ7  e 4.KJ982.QJT2.JT9  s J9.AT764.K8.8642  w KT832.53.A93.K53
1N 2N 3♣ -50 -5 ( 140 ) [5, 3, 3, 2, 14] [0, 4, 5, 4, 8]  n KT843.K95.K93.KQ  e AJ952.32.74.A652  s .JT84.AQT52.JT73  w Q76.AQ76.J86.984
1N 3♣ 3♦ -200 -7 ( 90 ) [6, 2, 2, 3, 13] [1, 4, 4, 4, 9]  n KQJ973.A7.73.K32  e 4.K6542.AKJT.JT7  s A.J983.Q942.Q864  w T8652.QT.865.A95
1N 2♦ 2♥ 260 -15 ( 1520 ) [5, 3, 2, 3, 15] [2, 6, 2, 3, 10]  n AQJ97.T65.A3.A63  e T52.J3.KQJ62.Q87  s K3.AK9742.85.T92  w 864.Q8.T974.KJ54
1N 2♦ 3♣ 170 -13 ( 920 ) [5, 3, 3, 2, 16] [0, 2, 5, 6, 11]  n KQ854.AK6.A83.T2  e A9763.QJ93.54.AJ  s .74.KQJT6.KQ7653  w JT2.T852.972.984
1N 2♦ 2♥ 170 -6 ( 420 ) [5, 1, 2, 5, 19] [1, 6, 4, 2, 8]  n AK965.8.AJ.AK974  e T743.QT93.Q4.Q52  s J.AK7642.T753.83  w Q82.J5.K9862.JT6
1N 3♣ 3♣ -50 -11 ( 450 ) [7, 4, 1, 1, 12] [1, 3, 3, 6, 11]  n AKT7543.KJ82.2.J  e 8.Q94.T7643.AT75  s J.AT6.AQ8.986432  w Q962.753.KJ95.KQ
1N 2♠ 3♠ 170 -13 ( 920 ) [6, 4, 0, 3, 17] [1, 2, 8, 2, 10]  n AJT643.AQ97..AQ8  e 85.J8632.Q5.KT95  s 2.K5.AKT96432.73  w KQ97.T4.J87.J642
1N 3♣ 3♠ 140 -4 ( 300 ) [6, 2, 2, 3, 15] [2, 6, 3, 2, 8]  n AJ9743.K4.42.AQJ  e K865.J2.K.KT8753  s Q2.AT9875.Q73.42  w T.Q63.AJT9865.96
1N 3♣ 3♣ -350 -6 ( -130 ) [7, 2, 2, 2, 12] [1, 3, 6, 3, 8]  n AKQ9854.52.K3.74  e JT62.76.J54.JT92  s 7.KJ3.QT9762.Q83  w 3.AQT984.A8.AK65
1N 2N 2N 120 -7 ( 420 ) [6, 3, 1, 3, 13] [1, 3, 5, 4, 10]  n AQJT92.JT7.T.AJ6  e K765.854.Q74.Q94  s 4.Q96.AKJ52.T875  w 83.AK32.9863.K32
1N 3♣ 3♣ -50 -14 ( 980 ) [5, 6, 1, 1, 15] [2, 2, 5, 4, 8]  n AQT72.AKJT64.5.J  e 986.52.AK8.KQ532  s K3.98.J9642.AT64  w J54.Q73.QT73.987
1N 2♥ 2♠ -100 1 ( -140 ) [5, 2, 5, 1, 12] [2, 3, 3, 5, 10]  n AQJ92.Q4.J9862.Q  e K53.KJ3.AQT74.T4  s 74.T95.K53.AK985  w T86.A8762..J7632
1N 3♣ 3N 430 0 ( 430 ) [5, 2, 2, 4, 13] [2, 2, 7, 2, 11]  n AKJ97.A3.63.J842  e Q54.92.J942.9765  s 62.75.AKQT875.Q3  w T83.KQJT864..AKT
1N 3♣ 3♠ -100 -6 ( 140 ) [5, 3, 3, 2, 13] [2, 4, 2, 5, 11]  n QJ876.KT3.AJ8.Q4  e KT93.872.9652.75  s 54.QJ96.KQ.KT832  w A2.A54.T743.AJ96
1N 2N 2N 210 -6 ( 460 ) [6, 2, 2, 3, 20] [2, 4, 4, 3, 9]  n AKQJ43.K3.KJ.K96  e 65.75.AQ9632.QT8  s 72.A986.T875.AJ3  w T98.QJT42.4.7542
Average imps -6.7
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Not very useful but can be improved by removing weak openers and with more training.

Running with 3 possible bids 2 miljon times;
Ended with opener always bidding 2 C (instead of always pass). Learning rate 1e-6 was used, maybe another run can be better.

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1♠-Bidding Contract Score Impdiff (Parscore) N[shape,hcp] S[shape,hpc]  N-cards E-cards S-cards W-cards
1N 2♣ 2♣ 110 -1 ( 140 ) [5, 3, 1, 4, 15] [2, 2, 6, 3, 10]  n AQ842.T65.A.AJ73  e 965.A73.K54.T852  s 73.Q4.QJT832.KQ4  w KJT.KJ982.976.96
1N 2♣ 2♣ -100 -5 ( 110 ) [6, 1, 3, 3, 12] [1, 5, 4, 3, 10]  n KQJ874.K.QT7.J83  e 3.Q8653.K9865.Q6  s 9.JT942.AJ42.A74  w AT652.A7.3.KT952
1N 2♣ 2♣ 130 -7 ( 400 ) [5, 2, 2, 2, 12] [1, 3, 4, 5, 11]  n KT842.54.AK.Q943  e 53.KJ63.J965.K86  s Q.QT8.Q432.AJ752  w AJ976.A972.T87.T
1N 2♣ 2♣ 110 -7 ( 400 ) [5, 3, 2, 3, 13] [1, 4, 4, 4, 11]  n AJ974.Q97.J6.AJ2  e KQ865.T4.Q82.985  s 3.AJ63.K943.KT76  w T2.K852.AT75.Q43
1N 2♣ 2♣ -200 -12 ( 450 ) [5, 6, 0, 2, 14] [1, 3, 7, 2, 9]  n AKT74.AJT863..Q9  e Q653.K5.QJ82.742  s 2.Q72.KT96543.KJ  w J98.94.A7.AT8653
1N 2♣ 2♠ 170 -13 ( 920 ) [5, 5, 2, 1, 15] [2, 1, 3, 7, 10]  n 86543.AQ543.AK.Q  e T72.T9.T96542.J6  s AJ.8.Q73.KT98542  w KQ9.KJ762.J8.A73
1N 2♣ 2♣ -50 -4 ( 110 ) [6, 1, 3, 3, 12] [1, 6, 3, 3, 9]  n AT9842.3.QJ3.KQ2  e K3.Q62.98742.AJ4  s 6.AJT854.AT5.T73  w QJ75.K97.K6.9865
1N 2♣ 2♣ 170 -13 ( 990 ) [5, 3, 2, 3, 19] [1, 4, 3, 5, 10]  n AKJ84.AJT.A2.Q93  e Q2.Q52.J974.AT64  s 5.K986.K63.KJ872  w T9763.743.QT85.5
1N 2♣ 2♣ -300 -5 ( -100 ) [5, 2, 5, 1, 12] [2, 2, 6, 3, 9]  n AJ975.92.KQ873.Q  e KT8.AT75..J98765  s Q3.K6.AT9542.T42  w 642.QJ843.J6.AK3
1N 2♣ 2♣ 150 -6 ( 400 ) [5, 2, 2, 4, 14] [2, 4, 2, 5, 10]  n AKT98.J4.K5.QJ75  e QJ75.K96.Q872.K9  s 42.Q852.A3.A8642  w 63.AT73.JT964.T3
1N 2♣ 2♣ 150 -6 ( 400 ) [5, 2, 1, 5, 12] [1, 4, 5, 3, 11]  n AK643.Q7.8.QJT63  e T72.KT5.AK7.9874  s 9.A963.QJ964.A52  w QJ85.J842.T532.K
1N 2♣ 2♣ 90 -2 ( 140 ) [5, 4, 2, 2, 12] [1, 4, 3, 5, 10]  n Q9876.AQ74.J2.QJ  e J42.9632.KQ84.54  s T.KT85.T97.AK862  w AK53.J.A653.T973
1N 2♣ 2♣ 90 -1 ( 120 ) [5, 3, 3, 2, 13] [2, 3, 3, 5, 8]  n AJT95.963.QJ9.KQ  e K4.K842.K7542.J6  s 73.T75.A86.AT842  w Q862.AQJ.T3.9753
1N 2♣ 2♣ 130 0 ( 140 ) [5, 2, 1, 5, 14] [2, 3, 5, 3, 11]  n AKT93.J2.J.KQT65  e Q5.AK85.982.9432  s 86.T94.AQT63.AJ8  w J742.Q763.K754.7
1N 2♣ 2♣ -200 -8 ( 140 ) [5, 3, 2, 3, 12] [1, 6, 4, 2, 10]  n AKQJ7.632.Q4.852  e 653.AT94.73.QJT3  s 9.KQJ875.KJ98.96  w T842..AT652.AK74
1N 2♣ 2♣ 110 0 ( 110 ) [6, 3, 3, 1, 13] [1, 2, 3, 7, 8]  n AK8752.K83.432.K  e J9.AJ942.AKT7.T6  s 4.Q5.QJ5.QJ85432  w QT63.T76.986.A97
1N 2♣ 2♣ 90 -8 ( 420 ) [6, 3, 4, 0, 14] [2, 2, 4, 5, 9]  n AK9865.A98.K985.  e 74.KQ64.T63.K853  s J2.32.QJ72.AJT76  w QT3.JT75.A4.Q942
1N 2♣ 2♣ 90 -8 ( 450 ) [5, 2, 1, 5, 14] [1, 7, 4, 1, 10]  n QJT53.A4.4.AQJT7  e K9.J73.A7532.K52  s A.KQT9652.JT86.8  w 87642.8.KQ9.9643
1N 2♣ 2♣ 150 -7 ( 450 ) [5, 2, 2, 4, 13] [2, 3, 5, 3, 11]  n AQT52.T9.KJ.K943  e 986.A643.QT.QJ52  s 73.K72.A8764.AT6  w KJ4.QJ85.9532.87
1N 2♣ 2♣ 130 -8 ( 460 ) [6, 3, 1, 3, 15] [1, 3, 5, 4, 11]  n AQJT43.A74.3.A75  e 9862.32.KQT62.42  s K.K98.AJ874.T963  w 75.QJT65.95.KQJ8
1N 2♣ 2♣ -100 -6 ( 140 ) [5, 4, 2, 2, 16] [1, 4, 5, 3, 8]  n AJT52.AQJT.86.KJ  e KQ98.2.K752.QT76  s 7.K543.AJT43.842  w 643.9876.Q9.A953
1N 2♣ 2♣ 130 -8 ( 460 ) [6, 3, 2, 2, 20] [1, 4, 4, 4, 11]  n AKT763.AQ7.KT.A5  e Q9542.T52.54.T92  s J.KJ84.J763.KQ83  w 8.963.AQ982.J764
1N 2♣ 2♣ 110 -7 ( 420 ) [6, 0, 3, 4, 12] [1, 4, 4, 4, 11]  n AK9765..972.KQT6  e JT42.AKQ872.A64.  s 8.J643.KQJ8.A854  w Q3.T95.T53.J9732
1N 2♣ 2♣ 130 0 ( 130 ) [5, 1, 2, 5, 12] [2, 3, 4, 4, 9]  n K9873.2.K4.AQ743  e AJ.AKQJT96.T9.J5  s 64.853.AQ85.KT82  w QT52.74.J7632.96
1N 2♣ 2♣ 90 -8 ( 420 ) [6, 4, 2, 1, 15] [0, 3, 5, 5, 8]  n AKQ632.Q832.A8.4  e T87.AK975.Q5.963  s .JT4.97432.AKT72  w J954.6.KJT6.QJ85
1N 2♣ 2♣ 90 0 ( 90 ) [5, 4, 2, 2, 12] [2, 2, 4, 5, 8]  n A9862.KJ53.KJ.84  e KQJ.AT6.T82.A953  s T4.Q2.9643.KQJ62  w 753.9874.AQ75.T7
1N 2♣ 2♣ 150 -7 ( 460 ) [5, 2, 3, 3, 19] [2, 4, 3, 4, 9]  n KQT94.AQ.AT6.A54  e J762.9632.93.J96  s 83.KJ87.K72.QT87  w A5.T54.QJ854.K32
1N 2♣ 2♣ -200 -8 ( 140 ) [7, 2, 1, 3, 16] [2, 5, 4, 2, 8]  n AKQT653.53.A.K96  e 987.762.T53.AT42  s 42.KQT84.QJ64.85  w J.AJ9.K9872.QJ73
1N 2♣ 2♣ -100 -11 ( 400 ) [5, 2, 4, 2, 12] [2, 5, 3, 3, 9]  n A9754.A6.T542.A4  e QJ.K542.QJ763.Q6  s 62.Q9873.A98.KT9  w KT83.JT.K.J87532
1N 2♣ 2♣ 110 -8 ( 450 ) [6, 4, 1, 2, 13] [2, 4, 2, 5, 9]  n AKQT43.KJ52.3.T2  e J87.AT7.AKT92.J7  s 65.Q963.86.AK984  w 92.84.QJ754.Q653
1N 2♣ 2♣ 150 2 ( 100 ) [6, 3, 0, 4, 15] [2, 3, 3, 5, 10]  n AKJ643.KT5..AT64  e 8.A98763.K7642.3  s 75.QJ4.J93.KQJ92  w QT92.2.AQT85.875
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1N 2♣ 2♣ -200 -12 ( 420 ) [5, 3, 2, 3, 15] [2, 7, 3, 1, 8]  n AK752.954.A4.KJ7  e JT96.A7.QJ8.AT82  s Q8.KQJT632.T65.6  w 43.8.K9732.Q9543
1N 2♣ 2♣ 90 -8 ( 450 ) [5, 3, 2, 3, 16] [2, 5, 4, 2, 11]  n AKJ83.AT8.KJ.764  e T942.J.A86.Q9832  s Q7.K9632.QT72.KJ  w 65.Q754.9543.AT5
1N 2♣ 2♣ -100 -5 ( 110 ) [6, 3, 3, 1, 12] [1, 3, 4, 5, 9]  n KQ8652.AJ2.Q53.8  e AT4.K94.K4.AJT73  s 7.T53.A762.KQ652  w J93.Q876.JT98.94
1N 2♣ 2♣ -200 -7 ( 100 ) [7, 3, 0, 3, 12] [0, 5, 7, 1, 10]  n KQJT432.QJ9..KT8  e 9865..JT94.A7643  s .K8432.AK87632.5  w A7.AT765.Q5.QJ92
1N 2♣ 2♣ 130 -13 ( 990 ) [5, 3, 2, 3, 17] [2, 4, 3, 4, 11]  n KQT54.A84.64.AKJ  e J3.Q752.872.T653  s A6.KJT6.K53.9872  w 9872.93.AQJT9.Q4
1N 2♣ 2♣ -100 -11 ( 430 ) [6, 4, 3, 0, 13] [2, 2, 4, 5, 9]  n KJ8732.AT54.KQ3.  e 94.Q632.JT854.KJ  s T6.J7.A962.A9852  w AQ5.K98.7.QT7643
1N 2♣ 2♣ 130 -7 ( 430 ) [5, 5, 2, 1, 17] [2, 3, 3, 5, 9]  n AKQ96.QT864.K3.K  e T743.A.AJ42.J643  s J8.972.QT9.AQ985  w 52.KJ53.8765.T72
1N 2♣ 2♣ 130 0 ( 130 ) [5, 1, 4, 3, 15] [2, 3, 3, 5, 9]  n AK765.5.Q975.AQ2  e Q4.AJT863.J64.53  s T3.KQ9.T83.KJ984  w J982.742.AK2.T76
1N 2♣ 2♠ -50 -4 ( 90 ) [6, 2, 3, 2, 12] [1, 4, 5, 3, 9]  n AT9843.A5.854.A3  e KQ765.T984.2.JT9  s J.K732.QJ976.Q72  w 2.QJ6.AKT3.K8654
1N 2♣ 2♣ 90 -16 ( 1440 ) [6, 1, 4, 2, 14] [1, 3, 6, 3, 11]  n AK8742.T.KT87.A3  e Q53.K7642.Q.Q642  s T.A85.A96432.KT7  w J96.QJ93.J5.J985
1N 2♣ 2♣ 130 -7 ( 400 ) [5, 3, 2, 3, 13] [1, 4, 3, 5, 11]  n AQJT7.QJ5.97.KT2  e K9632.AK.QJ4.Q65  s 4.8642.AK6.A9743  w 85.T973.T8532.J8
1N 2♣ 2♣ 130 0 ( 130 ) [6, 2, 1, 4, 13] [1, 3, 4, 5, 9]  n AQ9876.84.2.AQJ5  e JT.A965.QJT7.T76  s 2.QJ3.K543.K8432  w K543.KT72.A986.9
1N 2♣ 2♣ 90 -1 ( 120 ) [5, 2, 3, 3, 12] [2, 4, 4, 3, 11]  n K9763.A5.962.KQ4  e A5.J832.K54.J953  s J2.QT96.AT73.AT6  w QT84.K74.QJ8.872
1N 2♣ 2♣ -50 -11 ( 450 ) [6, 3, 1, 3, 14] [2, 6, 2, 3, 11]  n AKJ932.Q65.6.A93  e Q86.J8.T852.7642  s T4.KT9742.AK.J85  w 75.A3.QJ9743.KQT
1N 2♣ 2♣ -100 -14 ( 990 ) [7, 3, 1, 2, 20] [2, 5, 4, 2, 10]  n AKT8753.AQJ.Q.AT  e 4.83.J85432.6542  s QJ.K7542.KT97.J8  w 962.T96.A6.KQ973
1N 2♣ 2♣ 150 -7 ( 420 ) [5, 4, 1, 3, 16] [2, 2, 4, 5, 10]  n KJT76.Q863.A.AQT  e 52.AJ2.QT832.832  s Q9.K7.J975.KJ764  w A843.T954.K64.95
1N 2♣ 2♣ 130 -7 ( 420 ) [5, 1, 5, 2, 13] [2, 5, 1, 5, 11]  n QJ764.8.AKQ84.J6  e AT3.K52.9765.Q93  s K5.A7643.2.AT752  w 982.QJT9.JT3.K84
1N 2♣ 2♣ -200 -11 ( 300 ) [5, 4, 3, 1, 13] [2, 5, 4, 2, 11]  n AKQ92.KT76.J63.5  e JT84.Q842.942.A9  s 53.AJ953.KT87.K2  w 76..AQ5.QJT87643
1N Average imps -6.6
```

A try with bigger Neural net (from 75 to 100 neurons) and 11 possible bids instead of 6 resulted in 2C – pass on all deals, -7.7 imps/deal, worse..

A try with smaller net with 50 neurons and reducing layers (fully connected+ReLU) from 4 to 3: 2C-pass on all as well..

Suggestions/Ideas/Improvement
- maybe there are some bugs in the code
- trying to invent bidding backwards, reducing search space – no use to try 7NT with 13+9 hcp.
- try other algs like PPO A3C, Curiosity-based, Multi-Agent RL, evolutionary methods