

# RL Bridge bidding Inventor (on-going work)

An attempt to learn and use bidding systems.

As an example we used the continuation after 1 Spade (5+,12-21 h.c.p) – 1 NoTrump (0-2 spades, 8-11).

The idea is to have a policy to recommend an action (bid) given a situation (hand and the previous bidding).

By using DDS as recommended bids for a number of relevant hands we can train a policy-network with Reinforcement Learning. Here we used table-based Q-learning incl Eligibility traces,  $Q(\lambda)$ , for respective hand (spades, hearts, diamonds and h.c.p) and bidding history as state. As actions we allow pass and the nearest 11 bids for each round, maximum 4 bids + pass.

It seems to be a delicate balance between exploration (try new bids with probability epsilon) and exploitation (select bids known to be good) via parameter epsilon – usually one start with a larger value like 0.5 (select randomly 50%) down to 0.02 (select randomly only 2%; 98% best).

Moved from programming language Python to Julia for a speed improvement of ca 100x. Currently not using any GPU but trivial parallel processing on multiple-cores; run with different parameters and select best results. Memory requirements with 10 processes is about 27 GB RAM and this run took about 3 hours on a 6-core machine (5 years old Intel on Linux).

Some experimental bidding results (Intro is 1 – 1 NT. Only 1N = North passes). The topscore value is used with the difference presented and parScore in brackets. Rewards is average lost par-bid topscore count. (Imp is slower to learn because of coarser reward numbers). (Some earlier runs lost -180). The always-pass policy here results in a loss of about -258 points/deal. 2 “best” runs are shown.

a)

2	2	3	3N	n	AKQ985.K.AJ4.Q64	6133(19)	s	J3.QT8.KQ832.975	2353(8)	300	[100]
2	2	3	4	n	AJT632.K.Q.Q9762	6115(12)	s	Q7.A63.98543.KT4	2353(9)	50	[-100]
2	2	4	6	n	AKJT2.A.AJ9643.Q	5161(19)	s	Q.KQ987643.8.KJ6	1813(11)	0	[980]
2	2	3		n	KT983.K.KQJ8.A95	5143(16)	s	J.QT862.7642.KQJ	1543(9)	0	[130]
1N	n				AKQ95.T.K3.AJ875	5125(17)	s	J4.AJ852.985.K94	2533(9)	-710	[920]
1N	n				KJ873.J8.AKQ54.2	5251(14)	s	62.KQT95.J73.QT7	2533(8)	-50	[140]
2	2	2N4		n	Q9865.A53.AQ62.Q	5341(14)	s	K7.QJ8.754.K9832	2335(9)	-210	[110]
1N	n				QJ9542.QJ4.QJ.A5	6322(13)	s	T7.972.AK75.J986	2344(8)	20	[100]
1N	n				AJ972.AQT6.QT8.9	5431(13)	s	K5.K92.K43.QT854	2335(11)	-250	[430]

2 2 2N4 n AKQ53.AJ4.KT.J64 5323(18) s 64.Q9832.AQ4.952 2533(8) 0 [420]  
 1N n AJT984.K5.Q87.AJ 6232(15) s .A6.AJ63.T986543 0247(9) -250 [400]  
 1N n AJ954.QJT.T95.A2 5332(12) s 87.K864.2.KQT854 2416(8) -10 [100]  
 2 2 4 4 n KT8763..AKJT3.J2 6052(12) s A2.AT8.Q8762.T85 2353(10) -150 [100]  
 2 2 3 3N n AQ532.965.AKJ83. 5350(14) s K.QJ73.Q9762.732 1453(8) -430 [130]  
 1N n AKQJ6.74.Q76.T73 5233(12) s 97.KJ63.K4.A8654 2425(11) -20 [140]  
 2 2 3 4 n K8642.AT654.AJ7. 5530(12) s AT.J32.K532.JT84 2344(9) 0 [420]  
 2 2 3 4 n AKQ975.A4.A865.4 6241(17) s JT.Q965.K732.Q52 2443(8) 0 [420]  
 1N n KJ9632.AQ.QJ9.95 6232(13) s A8.964.864.AJ843 2335(9) -280 [430]  
 1N n AKT82.Q8.K76.983 5233(12) s J9.K632.AJT9.652 2443(9) -150 [100]  
 2 2 3 n AQ632.2.AK963.K2 5152(16) s K.J9543.QJT8.Q65 1543(9) -250 [400]  
 1N n AK632.KQ9.K43.A9 5332(19) s Q5.AJ632.J5.K652 2524(11) -770 [980]  
 1N n AKQ874.A64.5.T87 6313(13) s 2.Q53.K9862.KQ94 1354(10) -20 [140]  
 1N n Q9843.K4.A83.AK7 5233(16) s A5.QJ982.Q75.J32 2533(10) 0 [120]

Lr0.001 reward=-209.04

b)

1N n AQJ652.K.985.Q32 6133(12) s 83.AT8643.KQ.865 2623(9) -50 [-100]  
 1N n AKQ87.J65.K4.JT6 5323(14) s 2.9.AQJ832.K7542 1165(10) -150 [100]  
 1N n Q9762.KQ.A6.J984 5224(12) s J4.9764.J972.AK3 2443(9) -150 [100]  
 1N n KJ743.AQT4.8.K73 5413(13) s T6.K653.AQJT75.4 2461(10) -470 [420]  
 1N n QJ984.K.AJ42.A98 5143(15) s 3.Q62.K98763.KT3 1363(8) -180 [130]  
 2 3N4 6 n KJ532..AJ3.K9875 5035(12) s 7.AT9764.75.AQ42 1624(10) -600 [400]  
 2N4 n AKJT986.KJ97.2.3 7411(12) s .QT652.KJ3.QT942 0535(8) 320 [100]  
 1N n AJT54.K62.J84.K3 5332(12) s 8.QT8.A92.QT7652 1336(8) 0 [90]  
 1N n KQJ62.KJ3.543.Q6 5332(12) s T9.T92.Q82.AK942 2335(9) -250 [400]  
 1N n AKQ32.J7.QJ94.32 5242(13) s 75.AT.T653.KQT54 2245(9) 90 [-140]  
 2 2 3 4N n AQJ986.KQ72..762 6403(12) s K2.J.QT87642.KJ5 2173(10) -290 [140]  
 1N n AT743.T542.A.AJ9 5413(13) s K9.76.K72.KT6432 2236(9) -280 [400]  
 2 2 4 4 n AKQ83.KT.Q8.AK54 5224(21) s JT.J96.AKT75.T62 2353(9) -510 [990]  
 1N n AQT84.K75.QJ63.T 5341(12) s J.AT9632.KT98.83 1642(8) -190 [140]  
 2 3N4 n AKQJ62.KQ9.KJ54. 6340(19) s .AJ875.Q82.KJ532 0535(11) -500 [980]  
 2 2 3 3N n KQJ62.J9.AQ832.8 5251(13) s A3.62.K975.A7532 2245(11) -570 [420]  
 1N n AQ983.T54.KT9.AJ 5332(14) s 7.A732.AQJ.T9762 1435(11) 0 [120]  
 1N n AKJT63.82.K6.JT2 6223(12) s 42.K97.AJT87.Q75 2353(10) -160 [110]

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2 2 4 6      n AQT32.AK92.AQT.J  5431(20) s 6.T5.K984.KQT654  1246(8) 0 [920]
2 2N3 3N    n AQ932.Q54.AJ986.   5350(13) s 7.AK97.3.KJ98763  1417(11) 0 [400]
2 2 4 4      n AKJ632.5.T7.AJ74  6124(13) s 74.J62.AKQ543.T9  2362(10) -500 [980]
1N  n AKQJ6.Q84.AT8.K6  5332(19) s 8.AK732.K762.T85  1543(10) -750 [990]
1N  n AQ763.KJ4.Q862.T  5341(12) s 52.A953.AJ3.Q532  2434(11) 0 [120]
Lr0.001 reward=-212.19

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Some preliminar bidding systems (only first two bids are shown, two more is done but not shown here)

a)  
 \*\*\* Try 6 Lr=0.001 R=-209.041lambda=0.7eps=0.5 - 0.02 --- North 1st rebid ---

	12	14	16	18	20
5035	2	2	2	2	
5044	2	2	2	2	2
5053	2	2	2	2	2
5062	2	2	2	2	
5125	P	P	P	2	2
5134	P	P	2	2	2
5143	P	P	2	2	2
5152	P	P	2	2	2
5161	2	2	2	2	2
5215	P	P	P	2	2
5224	P	P	P	P	2
5233	P	P	P	P	2
5242	P	P	2	P	2
5251	P	P	2	2	2
5260	2	2	2	2	3
5305	2	2	2	2	
5314	P	P	P	2	2
5323	P	P	P	2	P
5332	P	P	P	P	P
5341	P	2	2	2	2
5350	2	2	2	2	2
5404	2	2	2	2	2
5413	P	P	2	2	2

5422	P	P	P	2	2
5431	P	2	P	2	2
5440	2	2	2	2	2
5503	2	2	2	2	2
5512	2	2	P	2	2
5521	2	2	2	2	2
5530	2	2	2	2	2
6016	2	2	2		
6025	2	2	2	2	2
6034	2	2	2	2	2
6043	2	2	2	2	2
6052	2	2	2	2	
6061	2	2	2		
6106	2	2	2		
6115	2	2	2	2	2
6124	P	P	2	2	2
6133	2	P	P	2	2
6142	2	P	2	2	2
6151	2	2	2	2	2
6160	2	2	2	2	
6205	2	2	2	2	
6214	2	P	2	2	2
6223	P	P	P	P	2
6232	P	P	P	2	2
6241	P	P	2	2	2
6250	2	2	2	2	
6304	2	2	2	2	2
6313	P	P	P	2	2
6322	P	2	2	2	2
6331	P	P	P	2	2
6340	2	2	2	2	
6403	2	2	2	2	
6412	P	2	2	2	2
6421	2	2	2	2	2

6430	2	2	2	2	
6502	2	2	2	2	2
6511	P	2	2	2	2
6520	2	2	2	2	2
6601	2	2	2NT		
6610	2	2	2	2	
7006	2				
7015	2	2	2		
7024	2	2	2		
7033	2	2	2	2NT	
7042	2	2	2	2	
7051	2	2	2		
7060	2				
7105	2	2	2		
7114	2	2	2	2	2
7123	P	2	2	2	2
7132	2	2	2	2	2
7141	2	2	2	2	
7150	2	2			
7204	2	2	2	2NT	
7213	P	2	2	2	2
7222	2	2	2	2	2
7231	2	2	2	2	2
7240	2	2	2	2	
7303	2	2	2	2	
7312	2	2	2	2	2
7321	2	2	2	2	2
7330	2	2	2	2	
7402	2	2	2	2	
7411	2	2	2	2	2
7420	2	2	2	2	2
7501	2	2	2		
7510	2	2			
7600	2NT	2			

--- South's Responses --- (up to 2 more bids are done in the bid sequence, not shown)

- to:	2	2	2	2	2	2NT	3	3	3	3	3NT									
h.c.p:	8-9	10+	8-9	10+	8-9	10+														
0166	3	2	2	3	4	3	2NT	3	4	4	3	3NT	3NT	5	3	3NT	4	4	4	P
0256	4	2	2	2	2	2NT	3	3	4	3	4NT	3	4NT	4	4NT	3NT	3NT	5	5	4
0265	2	2	2	2	2	3NT	3NT	2NT	3	4	P	4NT	3	3	3	4	5	5	4	P
0346	2	2	2	2	2	3	3NT	3	3	4	P	3NT	4	4	3	P	4	5	P	4
0355	2	2	2	2	2	2	P	3	3	4	3	4	3	5	3	3NT	4	4	5	4
0364	2	2	2	2	3NT	3	2NT	2NT	3	3	4	3	3	4	4NT	3NT	4	3NT	4	4
0436	2	2	2	2	2	3	3NT	3	3	4	3	3NT	3NT	3	4	4NT	5	4	P	P
0445	2	2	2	2	2NT	3	3NT	2NT	3	P	4	3	3	3	3NT	3NT	P	4	5NT	4NT
0454	2	2	2	2	3	2	3	3	3	4	3	P	4	4	4	5	4	P	4NT	5
0463	2	2	2	2	2	4	3	3NT	3	4	3	3	4	P	4	4NT	4	4	P	5
0526	2	2	2	2	4	4	3	3	P	4	3NT	4	3	3	3	3	4NT	5	4	P
0535	2	2	2	2	3NT	3NT	3	4	4	3	3	3	3NT	4	3	4NT	4	5	P	P
0544	2	2	2	2	3NT	3NT	3	4	3	4	3NT	5	3	4	P	3	3NT	4NT	4	4NT
0553	2	2	2	2	2	2	2NT	3	3	3	4	4	4	3	3	4	4NT	P	4NT	4
0562	2	2	2	4	4	3	2NT	3	4	3	4	3NT	3NT	4	3	3NT	3NT	4NT	4NT	4
0616	3	2NT	3NT	2	4	4	2NT	4	4	4	4	4	3	3NT	3NT	P	5	P	4	5
0625	2	2	2	2	3	2	3	3	3NT	3NT	4	4	4	4	5	4	4	5	5	5
0634	2	2	2	2	2NT	4	P	3	3	3NT	3	3	4	3	P	P	4	4	P	4
0643	2	2	2	2	3NT	2	3	4	P	3	4	3NT	3NT	4	4	5	4NT	4	P	4
0652	2	2	2	2	4	3	4	3	3NT	3	4	3	3	3	4	3	4NT	3NT	4	4NT
0661	3NT	3	3NT	3	2	2	3	3	3	3NT	4	4	3NT	4NT	4	4	4NT	4	5	P
1066	3	2NT	4	4	2NT	2NT	3NT	3	4	3	4	3NT	4	4	4	4	3NT	4	4	4
1156	2	2	2	2	2	2	3	2NT	4	3	3	4	3NT	3	4	3NT	3NT	4	4	4
1165	4	3	2	2	4	2NT	4	3NT	3	3	P	3	3NT	4	3NT	3	P	3NT	5	4
1246	2	2	2	2	2	2	4	3NT	3	4	3	3	4	3	4NT	4	3NT	5	4	4
1255	2	2	2	2	2	2	P	P	3	4	P	3	3NT	3	4	3	3NT	4	4	4
1264	2	2	2	2	2	3	3	3	3	P	3	3	3	3NT	3NT	4NT	4	4	4	4
1336	2	2	2	2	2	2	3	3	3	3	3	3	4	P	3	4	3NT	P	4	P
1345	2	2	2	2	2	2	3	4	3	3NT	P	3NT	4	3	4	4	3NT	4NT	4	5
1354	2	2	2	2	2	2	2NT	2NT	3NT	3	3	P	P	P	5	3NT	3NT	4	P	5

1363	2	2	2	2	2	P	3	3	3	4	P	3NT	4	4	3	4	3NT	P	4	5
1426	2	2	2	2	2	3NT	3	2NT	4	3	3	3	4	P	4	4	5	3NT	P	4
1435	2	2	2	2	2	2NT	P	2NT	3	3NT	3	3	P	P	P	5	3NT	4	4NT	4
1444	2	2	2	2	2	3	4	3	3	3	3	3	4	P	P	4	3NT	5	4	4
1453	2	2	2	2	2	2	4	2NT	P	3	3	5	4	4	P	3	4	4	5	4
1462	2	2	2	2	2	2	3	2NT	3	3	4	P	P	3	4	P	3NT	4	4NT	4
1516	2	2	2	2	3	3	2NT	3	4	3	3	3NT	3	3NT	3	3NT	5	5	4	5
1525	2	2	2	2	2	2	2NT	2NT	4	3	3	3	3	4	4	3	5	3NT	4	5
1534	2	2	2	2	2	2	3	3	3	3NT	3NT	4	3	4	4	4	5	3NT	5	4
1543	2	2	2	2	2	2	3	P	3NT	3NT	4	3	4	3	4	3	3NT	4	4	5
1552	2	2	2	2	3NT	3	3	2NT	3NT	3	3NT	3NT	3	3	4	P	P	5	4	P
1561	2	2	2	2	4	3NT	4	2NT	3	3NT	3	3	3	4	3NT	3	4	4	4	4
1606	2	2	2	4	P	4	3	3	4	4NT	P	4	3	4	3	5	5	5	5	4
1615	2	2	2	2	3	3	2NT	3	4	3NT	3NT	3	4NT	4	4	4	4	P	P	4
1624	2	2	2	2	3	2	3	4	3NT	3	3	4	3NT	4	3	4	4	4	P	4
1633	2	2	2	2	3	3NT	4	4	4NT	3	3	3	3	4	3NT	4	4	4	5	4
1642	2	2	2	2	3	2	P	3	P	P	3	3NT	4	3	3	P	3NT	4	4	5
1651	2	2	2	2	3	3	4	2NT	4	3	4	4	3	5	4	4	4	3NT	4	4
1660	2	2	2	2	3	3	4	4	3	3	4NT	4	3	4	3	4	4	4NT	4	4
2056	2	4	2	4	2	2	2NT	3	3	3NT	4	3NT	4	4	3	P	4	4	4	5
2065	2	3	2	2	2NT	4	2NT	3	3	3	4	3	3	3	3	5	P	4	4	P
2146	2	2	2	2	2	2NT	3	4	4	3	3	5	3	3	3	4	5	P	4NT	4
2155	2	2	2	2	2	2NT	3	4	3	P	3	3	3	4	4	3	P	5	4	4
2164	2	2	2	2	2	2	P	3	3	3	4NT	3	3	3	3	3	P	5	4NT	4
2236	2	2	2	2	2	2	P	3	3	P	3	3	P	4	3	3NT	4	P	4	4NT
2245	2	2	2	2	2	2	P	P	P	3	4	3	3	3	3NT	3	3NT	4	4	5
2254	2	2	2	2	2	2	3	3	3	3	3	4NT	3	3	4	3NT	4	4	P	P
2263	2	2	2	2	2	2	P	2NT	3	3	3	3	3	3NT	4	4	3NT	4	P	4
2326	2	2	2	2	2	2	4	P	3	3	P	4	4	4	4NT	P	3NT	P	4NT	4
2335	2	2	2	2	2	2	2NT	2NT	4	3	3	3	3	3	P	P	3NT	3NT	P	4NT
2344	2	2	2	2	2	2	3	2NT	3	3	3	4	P	3	3NT	3	3NT	5	4	4
2353	2	2	2	2	2	2	3	P	3	3	3	P	3	3	4	4	3NT	P	P	4
2362	2	2	2	2	2	2	3	P	3	3	3	3	3	3	3NT	4NT	3	4	4	4
2416	2	2	2	2	4	3NT	2NT	3	3	4	4	3	5	4	4	4	4	4	5NT	P

2425	2	2	2	2	2	2	3	3	3	4NT	5	3	3	3	4	4	5	4	5	P
2434	2	2	2	2	2	2	2NT	2NT	3	3	3	3	3	3NT	4	3	3NT	4NT	4	4
2443	2	2	2	2	2	2	2NT	4	3	3	3	3	P	P	4	3NT	P	3NT	P	4
2452	2	2	2	2	2	2	3	P	3	4	3	3	4	4	3	3	3NT	4	4	4
2461	2	2	2	2	2	2	3NT	3	P	3	4	3	4	P	4	P	4	4	P	4
2506	2	2	2	2	4	3	3	3	3	4	4	3	3	4	3NT	4	4	4	4	4
2515	2	2	2	2	3	2	2NT	3	4	3	4NT	3	3	4	4	4	P	4	4	5
2524	2	2	2	2	2	2	P	4	P	4	P	4	3	4	3	P	P	P	4	4
2533	2	2	2	2	2	2	3	P	3	3	3	3	3	5	4	P	4NT	4	4	P
2542	2	2	2	2	2	2	3	P	3	3	3	3	3	3	3NT	5	4	3NT	5	5
2551	2	2	2	2	2	3NT	3	3	3NT	4	4	3	4	3NT	4	P	3NT	P	4NT	4NT
2560	4	2	2	2	3	3	3	4	4	3	3	5	4	3	4NT	3NT	4	4	4	4
2605	2	2	2	2	3	3NT	3	3	4	4	3	5	4	4	4	4	3NT	4	P	5
2614	2	2	2	2	2	3	3NT	3	3	4	4	4	4	3NT	3NT	P	4	4	5	4
2623	2	2	2	2	2	2	2NT	3	3	3	3	4	3	4	4	4	4	P	P	4
2632	2	2	2	2	2	3	4	2NT	P	P	4	3	3NT	4NT	3NT	4	4	5	P	4
2641	2	2	2	2	2	3	2NT	3NT	3	P	4NT	3	P	3	3NT	4	3NT	3NT	4	4
2650	3	2	2NT	2	4	4	3	2NT	3NT	3	3	3NT	3	3NT	3	P	4NT	4	P	5

b)

\*\*\* Try 1 Lr=0.001 R=-212.191lambda=0.5eps=0.5 - 0.02 --- North 1st rebid ---

	12	14	16	18	20
5035	2	2	2	2	
5044	2	2	2	3	2
5053	2	2	2	2	2
5062	2	2	2	2	
5125	2	2	2	2	2
5134	P	P	P	2	2
5143	P	P	P	2	2
5152	P	2	2	2	2
5161	2	2	2	3	2
5215	P	P	2	2	3
5224	P	P	P	P	2
5233	P	P	P	P	2
5242	P	P	P	2	2



5251	2	3	2	3	2
5260	2	2	2	2	3
5305	2	3	2	2	
5314	P	P	P	2	2
5323	P	P	P	2	2
5332	P	P	P	P	2
5341	P	P	P	2	2
5350	2	2	2	2	3
5404	2	2	2	2	3
5413	P	P	P	2	3
5422	P	P	P	2	2
5431	P	P	P	2	2
5440	2	2	3	2	2
5503	2	2	2	2	2
5512	P	2	2	2	2
5521	P	P	2	3	2
5530	2	2	2	2	2
6016	2	2	3		
6025	2	2	2	2	2
6034	2	2	2	2	2
6043	2	2	2	2	2
6052	2	2	2	3	
6061	3	2	2		
6106	3	2	2		
6115	2	2	3	3	2
6124	2	P	3	2	2
6133	P	P	2	2	2
6142	P	2	2	2	2
6151	2	2	2	2	2
6160	2	2	2	2	
6205	3	2	2	2	
6214	2	P	2	2	2
6223	P	P	P	2	3
6232	P	P	P	2	2

6241	P	2	2	2	2
6250	2	2	2	2	
6304	3	2	2	3	2
6313	P	P	2	2	2
6322	P	P	P	3	2
6331	P	3	2	2	3
6340	2	2	2	2	
6403	2	2	3	2	
6412	2	2	2	2	2
6421	P	2	2	2	2
6430	3	2	2	2	
6502	2	2	2	3	2
6511	2	2	2	2	3NT
6520	2	2	2	2NT	3
6601	2NT	2	3		
6610	2	3	2	2	
7006	3				
7015	3	2	3		
7024	2	2NT	2		
7033	2	3	2	2NT	
7042	2NT	2	2	2	
7051	2	2	2		
7060	2				
7105	3	2	3		
7114	2	3	2	2	2
7123	3	2	2	2	2
7132	3	3	2	2	3
7141	2	2	2	3	
7150	2NT	2			
7204	2	2	2	3	
7213	2	2	2	2	2
7222	2	2	2	3	2
7231	2	2	2	2	2
7240	2	2	2	2	

7303	3	2	3	2	
7312	2	2	2	2	2
7321	3	2	2	2	2
7330	2NT	2	2	3	
7402	3	3	2	3	
7411	2NT	3	2	2	2
7420	2	3	2	2	2
7501	2	2	2		
7510	3	2			
7600	2	2			

--- South's Responses ---

- to:	2	2	2	2	2NT	3	3	3	3	3NT										
h.c.p:8-9	10+	8-9	10+	8-9	10+															
0166	2	3NT	3	2NT	3	2NT	3	3	4	3	3	4	4	3	3	4	4	4	4	P
0256	2	2	3	3	2	2	3	3	4	4	3NT	3	4	4	3NT	4	4	4	4	5
0265	3NT	3NT	2NT	3	2	4	3	3	4	4	3	4	3	3	3NT	4	4	3NT	4	4
0346	3NT	3NT	2	2	2NT	4	2NT	2NT	3	4	4	4	4	3	4	5	3NT	P	4	4
0355	2	2	3	3NT	2NT	2	3NT	3	P	3	3	3	P	4	3	4	4NT	4	4	4
0364	3NT	3NT	3	2	2NT	3	2NT	3	P	3NT	3	3	4	3	3	4	4	3NT	4NT	4
0436	3NT	3NT	2	2	2	3	3	4	4	4	3	3	4	4	4	3	3NT	4	4	4
0445	2	3NT	2	2	2	2	3	4	4	3	3	3NT	3	4	P	4	5	3NT	4	4
0454	2	3NT	2	2	3NT	2NT	3	3	3NT	4	3	3	3NT	3NT	3	3	4	4	4	4
0463	3NT	3NT	3	2	2NT	3NT	3NT	3NT	4	4NT	3	3	3	4	P	3	4NT	5	4	4
0526	3NT	3NT	2	3	2NT	3	3	3NT	3	3	4	3	4	3	5	4NT	P	4	4	4
0535	3NT	3NT	2	2	P	2NT	2NT	3	4	3	3	3	3	3	4	3NT	5	4	4	4
0544	3NT	3NT	2NT	2	2	2NT	3	3	P	P	3	4	3	3	3	3	4	3NT	4	4
0553	3NT	3NT	2	2	3NT	2	3	2NT	3	4	3	4	4	4	3	4	3NT	4	4	4
0562	3NT	3NT	4	3	2	2	3	3NT	3	3NT	4	5	4	4NT	3NT	3	4	5	4	4
0616	3NT	3NT	3	4	4	3	3	2NT	4NT	4NT	4	3	3NT	4	P	P	4	4	4	4NT
0625	2	3NT	2	4	2	2NT	4	4	3	4	3	3	4	4NT	4	3NT	4	4	P	4
0634	3NT	3NT	2	2	2	2	3	4	3	3	3NT	3	4	3NT	4NT	3NT	4	4NT	P	5
0643	3NT	3NT	2	2	2NT	2	3	3	4	3	3	3	4	3NT	3	3NT	4	P	4	P
0652	3NT	3NT	2	2	2NT	2	3	2NT	3	3	3	3	4	4	4	4	4NT	5	5	4NT

0661	3NT	3NT	2	3	3	4	4	3	3	3	3NT	5	4	3	3	4NT	4	4NT	4	4
1066	4	3NT	4	3	4	3	3	3	3	4	3	4	4	3NT	3	3NT	4	4	4	4
1156	2	3NT	2	3	2	3	P	3	3	3	4	4	3	4	5	5	4	3NT	4	4
1165	3NT	3NT	3	3	2	2NT	3	3	3	3NT	3	3	4	4	4	3	4	3NT	P	5NT
1246	2	2	2NT	4	2	3NT	P	3NT	4	3	3	3	3	4	3NT	4	4NT	3NT	P	4
1255	2	2	2	2	2	3NT	3	3	4	3	4	3	3NT	3	4	4	4	4	4	4NT
1264	2	2	2	3	2	4	3	2NT	4	3	3	3	4	3	4NT	3NT	4	4	4	4
1336	2	2	2	2	2	2	3	4	3	4	4	3	4	3	4	4	3NT	4	4	4
1345	2	2	2	3	2	2	3	2NT	3	4	3	4	4	3NT	4	4	4NT	3NT	4	4
1354	2	2	2	2	2	3NT	2NT	2NT	4	3	4	4	3	3	4	4	4	3NT	5	4
1363	3NT	2	2	2	2	2NT	4	2NT	3	4	4	3	3	4	4	4	5	4	4	4NT
1426	3NT	2	2	2NT	2NT	2NT	2NT	3NT	3	4	4	3	3	4	4	4	5	3NT	4	5
1435	2	2	3	3	2	2	3	3	3	4	4	3	4	3	4	4	3NT	3NT	4	5
1444	2	2	3	3NT	2	2	2NT	4	3	4	4	4	3NT	4	4	4	4	4	4	4
1453	2	2	2	2	2	2	2NT	3	3	3	4	4	4	3	3	4	4	4	4	5NT
1462	3NT	3NT	2	2	2	2	2NT	3	4	3	3	3	3	3	3NT	4	4	4	4	4
1516	3NT	2	2NT	3	2NT	3NT	3	3	3	3	3	3	5	3	4	4	4	4	4NT	4
1525	3NT	2	2	2	2NT	3NT	4	3	4	4	4	4	4	3	4	3	5	4	4	4
1534	2	2	3NT	2	2	2	4	2NT	4	3	4	4	3NT	4	4	4	3NT	3NT	4	P
1543	2	2	2	2	2	2	3	4	3	4	4	3	4	3	3	5	4	5	4	4
1552	2	3NT	2NT	3	2	2	3	2NT	3	3	3	4	3	4	4	4	4	4	4	4
1561	3NT	2	2	2	2	2NT	4	3	3	4	3	3	3	3	3NT	4	4	5	5	4
1606	2	3	3	4	4	4	3NT	4	3	4NT	4	4	3	5	4	4NT	4NT	5	5	5
1615	3NT	3NT	2	3	P	2	3NT	4	3	3	3	3	3NT	3	4	4	4	P	4	4
1624	2	3NT	3	2	2	2	3	3NT	4	4	3	3	3	4	3	4	4	4	4	5
1633	2	2	2	2	2	2NT	2NT	4	4	3	3	4	3	3NT	P	4	4	4	4	4
1642	2	3NT	2NT	2	2	2	3	3	3	3	3	4	3	3NT	P	3NT	4	3NT	4	4
1651	3NT	3NT	3	2	2	2	2NT	3NT	4NT	3	3	4	4	3	3	3	4	4	4	4NT
1660	3NT	2	4	3	3	3	3	3	3	3NT	3	4	5	4NT	3NT	4NT	5	3NT	4NT	4NT
2056	3NT	3NT	4	2	2	2	3	3	3	3	4	3	3	3	3NT	3	4	4	5	P
2065	3NT	3NT	2NT	3	2NT	2NT	4	3	3	3	3	3	4	3	3NT	3	5	4	4	5NT
2146	2	3NT	2	3	2	3	3	3	3	3	3	4	3NT	3	3	4NT	3NT	4	4	4NT
2155	2	3NT	3	4	2	2NT	3	3	3	3	3	3	3	4	3	3NT	4	4	5	4
2164	2	3NT	3	2	2	4	3	3NT	4	3	4	3	3	4	4	3	4	4	4	4

2236	2	2	2NT	3	2	2	3	3NT	3	3	4	3	4	4	4	4	4	5	4	4
2245	2	3NT	2	4	2	2	3	2NT	4	4NT	4	3	3	3	3	3	4	4	4	4
2254	2	2	2NT	3NT	2	2	3	3	4	4NT	3	4	4	3NT	4	3NT	4	3NT	P	4
2263	2	2	2	3	2	2	3	3	4	3	4	4	4	3	3NT	5	4	3NT	4	4
2326	2	3NT	2	3	2	2	3	3	4	4	3	4	4	4	3NT	3	5	3NT	4	4
2335	2	2	2	2	2	2	3	2NT	4	3	4	4	4	5	4	4	P	3NT	4	4
2344	2	2	2	3	2	2	3	3	4	3	4	4	4	3NT	4	3	3NT	3NT	4	4
2353	2	2	2	2	2	2	4	3	4	3	3	4	3	3	3	3	4	3NT	4NT	4
2362	2	2	2	2	2	2	3	2NT	3	3	4	4	3	3	4	4	4	4	4	4NT
2416	2	2	3NT	3NT	2	2NT	2NT	2NT	4	3	3	4	4	4	3NT	4	4	3NT	4	4
2425	2	2	3	2	2	2	4	2NT	4	3	4	4	5	3	3	4	4	4	4	4
2434	2	2	2	2	2	2	4	3	4	3	4	4	4	4	4	4	4	3NT	4NT	4
2443	2	3NT	2	2	2	2	2NT	2NT	4	3	4	4	3NT	3NT	4	3	5	4NT	P	4
2452	2	2	2	4	2	2	2NT	2NT	3	4	3	4	4	4	4	5	4	4	4	5
2461	2	3NT	2	2	2	2	2NT	3	3	3	4	3	4	3	3	3NT	4	4	4	4
2506	2	3NT	2NT	3	4	2	2NT	3NT	3	3	3	3	3NT	5	P	3NT	4	4	4	4
2515	3NT	3NT	2NT	2	2	2NT	2NT	4	4	4	4	3	5	3	4	4	3NT	P	5	5
2524	2	2	2	2NT	2	2	3	4	4	3	4	3	3	3NT	3	4	4	3NT	4	4
2533	2	2	3	2	2	2	3	2NT	4	3	4	4	4	3	4	3	5	3NT	4	4
2542	2	2	3	2	2	2	3	4	4	3	4	4	4	3	4	3NT	4	4	4NT	4
2551	2	2	2	3	2	2	3	2NT	4	3	3	4	3NT	4	3NT	5	4	3NT	4	4
2560	2	3NT	3	4	2NT	4	3	4	4	4	4	3NT	4	3	4NT	4	5	4	4	4
2605	3NT	3NT	2NT	3	3	4	2NT	3	4	3	3	4	3	4NT	4	4	3NT	4	4	4NT
2614	2	2	2	2	2	2	3NT	3	4	4NT	4	4	4	4	3NT	4	3NT	3NT	4	4
2623	2	2	2	2	2	2	4	3	3	3	3	3	3	4	3	3	4	3NT	4	P
2632	2	2	2	2	2	2	3	3	3	4	3	3	4	4	4	4	4	4	4	5
2641	2	3NT	2	3	3NT	2	3	3	4	3	3	3	3	4	4NT	4	3NT	5	5	4
2650	3NT	3NT	2NT	2	3	P	2NT	3	4	4	4NT	4	5	3NT	3	4	4NT	5	4	4

