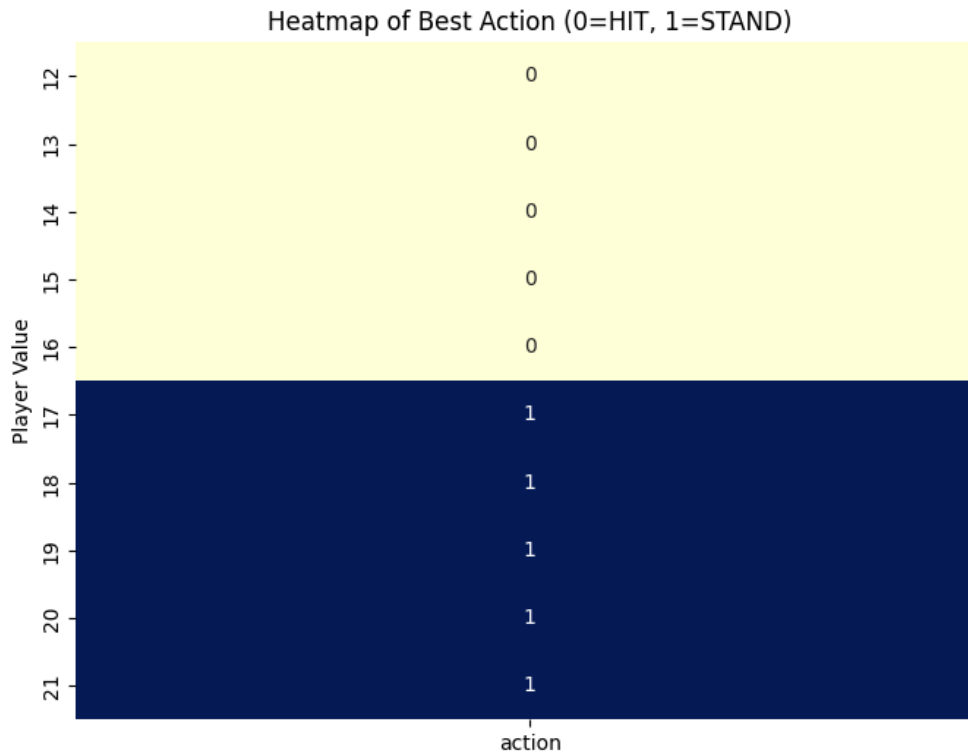


1) Strategy obtained from observing only own hand value:

- Strategy - hit from 12 to 16 and stand from 17 to 21
- we observe how better strategy leads to better average reward.
- the reward remains negative as the house still holds an edge.



./2025-02-26-1740560328873.png

• Output:

Avg reward after 10000 games = -0.27957204279572045
Avg reward after 20000 games = -0.21313934303284834
Avg reward after 30000 games = -0.17926069131028965
Avg reward after 40000 games = -0.15792105197370065
Avg reward after 50000 games = -0.14543709125817483
Avg reward after 60000 games = -0.13616439726004567
Avg reward after 70000 games = -0.12878387451607834
Avg reward after 80000 games = -0.12346095673804078
Avg reward after 90000 games = -0.11745425050832768
Avg reward after 100000 games = -0.11353886461135389
Avg reward after 110000 games = -0.11089899182734703
Avg reward after 120000 games = -0.10836576361863651
Avg reward after 130000 games = -0.10616072184060123
Avg reward after 140000 games = -0.10479210862779552
Avg reward after 150000 games = -0.1032593116045893

Avg reward after 160000 games = -0.10280560746495335
Avg reward after 170000 games = -0.101875871318404
Avg reward after 180000 games = -0.10172165710190499
Avg reward after 190000 games = -0.101162625459866
Avg reward after 200000 games = -0.09930950345248274
Avg reward after 210000 games = -0.09880905329022242
Avg reward after 220000 games = -0.0990222771714674
Avg reward after 230000 games = -0.09909087351794123
Avg reward after 240000 games = -0.09849542293573776
Avg reward after 250000 games = -0.09822360710557158
Avg reward after 260000 games = -0.09776116245706747
Avg reward after 270000 games = -0.09722186214125132
Avg reward after 280000 games = -0.09649608394255735
Avg reward after 290000 games = -0.09637897800352413
Avg reward after 300000 games = -0.095669681101063
Avg reward after 310000 games = -0.09511259641097931
Avg reward after 320000 games = -0.0951497026571792
Avg reward after 330000 games = -0.09481486419738122
Avg reward after 340000 games = -0.09452325140220176
Avg reward after 350000 games = -0.0944054445558727
Avg reward after 360000 games = -0.09368029533251296
Avg reward after 370000 games = -0.09312677533303965
Avg reward after 380000 games = -0.09219975736905955
Avg reward after 390000 games = -0.0922664300860767
Avg reward after 400000 games = -0.09186227034432413
Avg reward after 410000 games = -0.09210465340328439
Avg reward after 420000 games = -0.09164501989280978
Avg reward after 430000 games = -0.09130676440287348
Avg reward after 440000 games = -0.09101797495914782
Avg reward after 450000 games = -0.09079757600538665
Avg reward after 460000 games = -0.09082371560061826
Avg reward after 470000 games = -0.09060831785464286
Avg reward after 480000 games = -0.09071647767400484
Avg reward after 490000 games = -0.09045695825110561
Avg reward after 500000 games = -0.09018381963236073
Avg reward after 510000 games = -0.09056452830484646
Avg reward after 520000 games = -0.09049982596187316
Avg reward after 530000 games = -0.08996398120003547
Avg reward after 540000 games = -0.08973316716080156
Avg reward after 550000 games = -0.08959256437715568

Avg reward after 560000 games = -0.08937126897987682
Avg reward after 570000 games = -0.08944896587900723
Avg reward after 580000 games = -0.08912570840395102
Avg reward after 590000 games = -0.08888798493561875
Avg reward after 600000 games = -0.08873318544469093
Avg reward after 610000 games = -0.08859329738803706
Avg reward after 620000 games = -0.08844501863706672
Avg reward after 630000 games = -0.088079225271071
Avg reward after 640000 games = -0.0880998623439651
Avg reward after 650000 games = -0.08795986467713127
Avg reward after 660000 games = -0.08816350278257154
Avg reward after 670000 games = -0.08823718173554965
Avg reward after 680000 games = -0.0882219290853984
Avg reward after 690000 games = -0.08811001723185909
Avg reward after 700000 games = -0.0882441596512005
Avg reward after 710000 games = -0.08852804432669813
Avg reward after 720000 games = -0.08843182162246997
Avg reward after 730000 games = -0.08806700264794158
Avg reward after 740000 games = -0.08830934012251335
Avg reward after 750000 games = -0.08877054830593559
Avg reward after 760000 games = -0.08890251460195447
Avg reward after 770000 games = -0.08894533903202723
Avg reward after 780000 games = -0.08887809118193438
Avg reward after 790000 games = -0.08879609013153147
Avg reward after 800000 games = -0.08852238934701331
Avg reward after 810000 games = -0.08837026127128238
Avg reward after 820000 games = -0.08811818522172533
Avg reward after 830000 games = -0.08802037587906521
Avg reward after 840000 games = -0.08778560977903598
Avg reward after 850000 games = -0.08778460260634988
Avg reward after 860000 games = -0.0877347817037422
Avg reward after 870000 games = -0.08763438202944594
Avg reward after 880000 games = -0.0875874004688631
Avg reward after 890000 games = -0.08763810377741149
Avg reward after 900000 games = -0.08750101388776235
Avg reward after 910000 games = -0.08731089306495268
Avg reward after 920000 games = -0.08708468795142614
Avg reward after 930000 games = -0.08698377743679846
Avg reward after 940000 games = -0.08692118412639986
Avg reward after 950000 games = -0.08683885595909899

Avg reward after 960000 games = -0.08662386810013739
Avg reward after 970000 games = -0.0866174364768696
Avg reward after 980000 games = -0.08649480969917378
Avg reward after 990000 games = -0.08681607392315766
Avg reward after 1000000 games = -0.08684291315708684

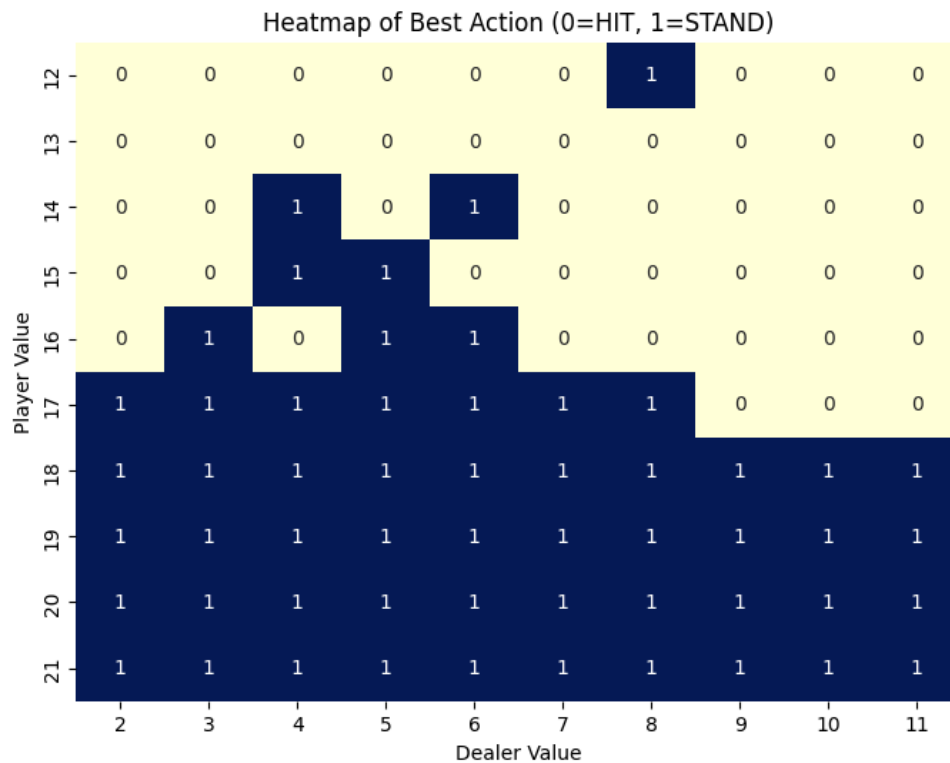
Learned Q-Table:

State (PlayerValue) | Q(HIT) | Q(STAND)

12 | -0.251 | -0.868
13 | -0.210 | -0.658
14 | -0.503 | -0.906
15 | -0.321 | -0.913
16 | -0.623 | -0.831
17 | -0.785 | -0.213
18 | -0.756 | 0.150
19 | -0.840 | 0.312
20 | -0.564 | 0.517
21 | -0.415 | 0.979

2) Strategy obtained from observing own hand value and dealer hand value

- we also notice that having more information improves the overall average reward and our winning chances



./2025-02-26-1740559605080.png

- Output:**

Avg reward after 10000 games = -0.2636736326367363
 Avg reward after 20000 games = -0.20123993800309983
 Avg reward after 30000 games = -0.1704943168561048
 Avg reward after 40000 games = -0.14534636634084147
 Avg reward after 50000 games = -0.13371732565348693
 Avg reward after 60000 games = -0.12404793253445776
 Avg reward after 70000 games = -0.11334123798231453
 Avg reward after 80000 games = -0.10773615329808377
 Avg reward after 90000 games = -0.10344329507449918
 Avg reward after 100000 games = -0.0985590144098559
 Avg reward after 110000 games = -0.09696275488404651
 Avg reward after 120000 games = -0.09536587195106708
 Avg reward after 130000 games = -0.09327620556764948
 Avg reward after 140000 games = -0.09097077878015157
 Avg reward after 150000 games = -0.08865940893727375
 Avg reward after 160000 games = -0.08714945531590428
 Avg reward after 170000 games = -0.08518185187145957
 Avg reward after 180000 games = -0.08336620352109154
 Avg reward after 190000 games = -0.08277851169204373
 Avg reward after 200000 games = -0.08250958745206274
 Avg reward after 210000 games = -0.0813758029723668

Avg reward after 220000 games = -0.08049054322480352
Avg reward after 230000 games = -0.0795822626858144
Avg reward after 240000 games = -0.07919133670276374
Avg reward after 250000 games = -0.07938368246527014
Avg reward after 260000 games = -0.07866123591832339
Avg reward after 270000 games = -0.07865156054977575
Avg reward after 280000 games = -0.07832114885303981
Avg reward after 290000 games = -0.07795490360378067
Avg reward after 300000 games = -0.07755974146752845
Avg reward after 310000 games = -0.07759652388218102
Avg reward after 320000 games = -0.07784663172927585
Avg reward after 330000 games = -0.0773997654552562
Avg reward after 340000 games = -0.07751153673077432
Avg reward after 350000 games = -0.07694263730675055
Avg reward after 360000 games = -0.07650812081077553
Avg reward after 370000 games = -0.07591601103780801
Avg reward after 380000 games = -0.0755655906168668
Avg reward after 390000 games = -0.07524083271581355
Avg reward after 400000 games = -0.07474231314421714
Avg reward after 410000 games = -0.07435103816819959
Avg reward after 420000 games = -0.0739688715026869
Avg reward after 430000 games = -0.07393936293171412
Avg reward after 440000 games = -0.07338846957166006
Avg reward after 450000 games = -0.0733109481978929
Avg reward after 460000 games = -0.07343244905989335
Avg reward after 470000 games = -0.07344877989621298
Avg reward after 480000 games = -0.07298943127201818
Avg reward after 490000 games = -0.0729202593464095
Avg reward after 500000 games = -0.07273385453229093
Avg reward after 510000 games = -0.07254103423326622
Avg reward after 520000 games = -0.07258255272586014
Avg reward after 530000 games = -0.07243571238544833
Avg reward after 540000 games = -0.07224431065868396
Avg reward after 550000 games = -0.07227077768949511
Avg reward after 560000 games = -0.07212129978339324
Avg reward after 570000 games = -0.07201215436464146
Avg reward after 580000 games = -0.07199470345740783
Avg reward after 590000 games = -0.07173886145955685
Avg reward after 600000 games = -0.07156988071686547
Avg reward after 610000 games = -0.07136381743636486

Avg reward after 620000 games = -0.07106924021090288
Avg reward after 630000 games = -0.07105544276913846
Avg reward after 640000 games = -0.07093582666277085
Avg reward after 650000 games = -0.07089219862738673
Avg reward after 660000 games = -0.07092413496343188
Avg reward after 670000 games = -0.07085959573194667
Avg reward after 680000 games = -0.07069695485741932
Avg reward after 690000 games = -0.0704027965176862
Avg reward after 700000 games = -0.07049275643891938
Avg reward after 710000 games = -0.07035483048615425
Avg reward after 720000 games = -0.07034018008308322
Avg reward after 730000 games = -0.07026428730919547
Avg reward after 740000 games = -0.07014179710567958
Avg reward after 750000 games = -0.07026790630945826
Avg reward after 760000 games = -0.06997622371549511
Avg reward after 770000 games = -0.0698284807422328
Avg reward after 780000 games = -0.06997042311484217
Avg reward after 790000 games = -0.06971889909000115
Avg reward after 800000 games = -0.0696299129626088
Avg reward after 810000 games = -0.06982830885393969
Avg reward after 820000 games = -0.06972186619284611
Avg reward after 830000 games = -0.06951316926124185
Avg reward after 840000 games = -0.06968325037708288
Avg reward after 850000 games = -0.06972109444577124
Avg reward after 860000 games = -0.06970340732161939
Avg reward after 870000 games = -0.06967808082979216
Avg reward after 880000 games = -0.0696033299962159
Avg reward after 890000 games = -0.0695235173893063
Avg reward after 900000 games = -0.06954881161243154
Avg reward after 910000 games = -0.06940761603558677
Avg reward after 920000 games = -0.06939775065461885
Avg reward after 930000 games = -0.069262291115816
Avg reward after 940000 games = -0.06915630940818147
Avg reward after 950000 games = -0.0691094009374727
Avg reward after 960000 games = -0.06906138639438918
Avg reward after 970000 games = -0.06905147520466473
Avg reward after 980000 games = -0.06896523574975943
Avg reward after 990000 games = -0.06904740500262121
Avg reward after 1000000 games = -0.06891093108906891

Learned Q-Table:

State (PlayerValue, DealerValue) | Q(HIT) | Q(STAND)

18,10 | -0.842 | -0.323

18,11 | -0.914 | -0.253

21,4 | -0.436 | 0.937

21,3 | -0.497 | 0.734

21,2 | 0.069 | 0.818

21,9 | -0.653 | 0.975

21,8 | -0.192 | 0.976

21,7 | -0.502 | 0.954

21,6 | -0.164 | 0.861

21,5 | -0.190 | 0.898

13,11 | -0.373 | -0.873

13,10 | -0.685 | -0.911

17,9 | -0.788 | -0.336

17,8 | -0.876 | -0.523

17,7 | -0.676 | 0.059

17,6 | -0.573 | -0.251

17,5 | -0.731 | 0.121

13,9 | -0.161 | -0.702

17,4 | -0.791 | -0.142

13,8 | -0.363 | -0.840

13,7 | -0.314 | -0.783

17,3 | -0.711 | -0.433

13,6 | -0.605 | -0.220

17,2 | -0.845 | 0.125

13,5 | -0.433 | -0.699

13,4 | -0.168 | -0.807

13,3 | -0.414 | -0.637

13,2 | -0.817 | -0.232

12,11 | -0.473 | -0.894

12,10 | -0.465 | -0.897

20,5 | -0.944 | 0.676

20,4 | -0.541 | 0.938

20,3 | -0.565 | 0.870

20,2 | -0.722 | 0.394

20,9 | -0.695 | 0.571

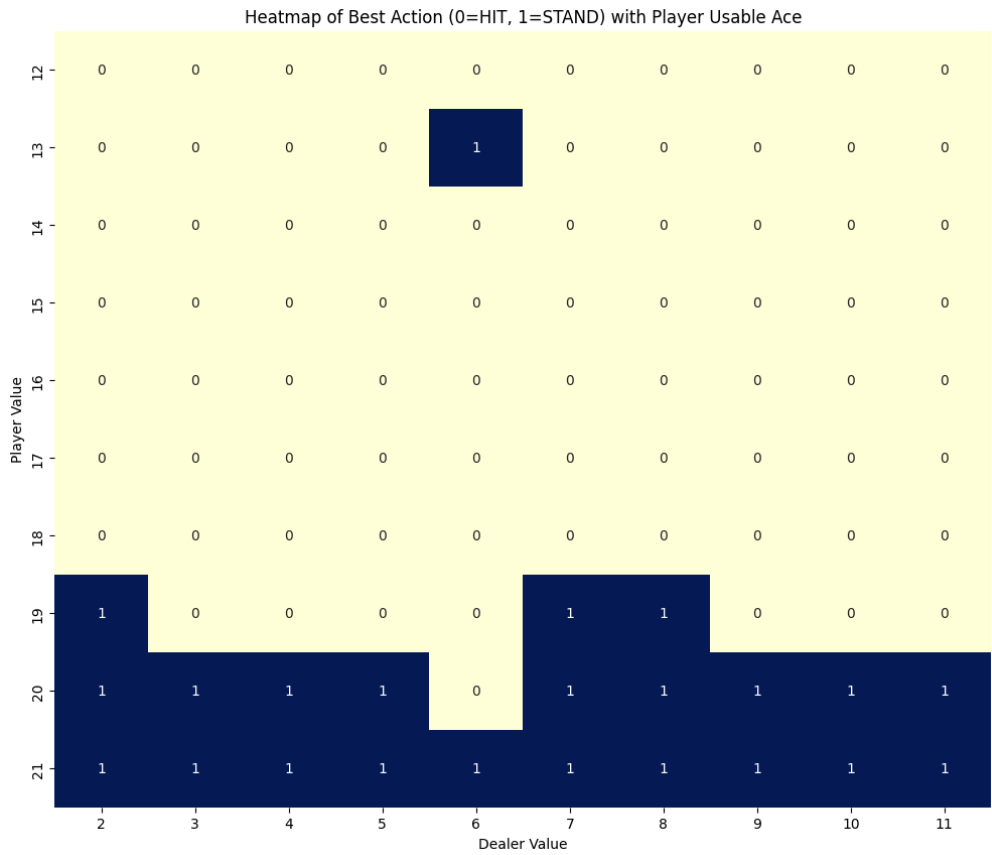
20,8 | -0.665 | 0.793

20,7 | -0.806 | 0.808
20,6 | -0.664 | 0.433
15,11 | -0.803 | -0.987
16,9 | -0.663 | -0.855
16,8 | -0.540 | -0.909
16,7 | -0.358 | -0.819
15,10 | -0.506 | -0.913
12,2 | -0.304 | -0.837
16,6 | -0.724 | -0.330
16,5 | -0.824 | -0.213
12,9 | -0.462 | -0.804
21,11 | -0.699 | 0.521
12,8 | -0.217 | -0.793
16,4 | -0.636 | -0.881
21,10 | -0.135 | 0.991
12,7 | -0.306 | -0.688
16,3 | -0.868 | -0.426
16,2 | -0.483 | -0.825
12,6 | -0.346 | -0.621
12,5 | -0.214 | -0.797
12,4 | -0.413 | -0.776
12,3 | -0.277 | -0.771
14,10 | -0.615 | -0.852
14,11 | -0.095 | -0.944
20,11 | -0.861 | 0.111
20,10 | -0.719 | 0.485
19,9 | -0.444 | 0.258
19,8 | -0.497 | 0.745
19,7 | -0.898 | 0.739
19,6 | -0.330 | 0.218
19,5 | -0.590 | 0.494
15,9 | -0.394 | -0.915
19,4 | -0.572 | 0.108
15,8 | -0.141 | -0.874
17,10 | -0.898 | -0.226
17,11 | -0.589 | -0.955
19,3 | -0.556 | 0.138
15,7 | -0.487 | -0.837
19,2 | -0.682 | 0.559
15,6 | -0.336 | -0.880

15,5 | -0.742 | -0.115
15,4 | -0.364 | -0.757
15,3 | -0.761 | -0.166
15,2 | -0.754 | -0.451
16,11 | -0.390 | -0.925
16,10 | -0.664 | -0.915
18,9 | -0.823 | -0.029
18,8 | -0.529 | 0.097
18,7 | -0.909 | 0.502
18,6 | -0.677 | 0.509
18,5 | -0.641 | 0.181
14,9 | -0.559 | -0.888
19,11 | -0.788 | 0.024
19,10 | -0.752 | -0.488
18,4 | -0.487 | -0.175
14,8 | -0.222 | -0.760
14,7 | -0.371 | -0.926
18,3 | -0.533 | 0.488
18,2 | -0.887 | -0.086
14,6 | -0.500 | -0.707
14,5 | -0.330 | -0.806
14,4 | -0.193 | -0.782
14,3 | -0.385 | -0.764
14,2 | -0.400 | -0.822

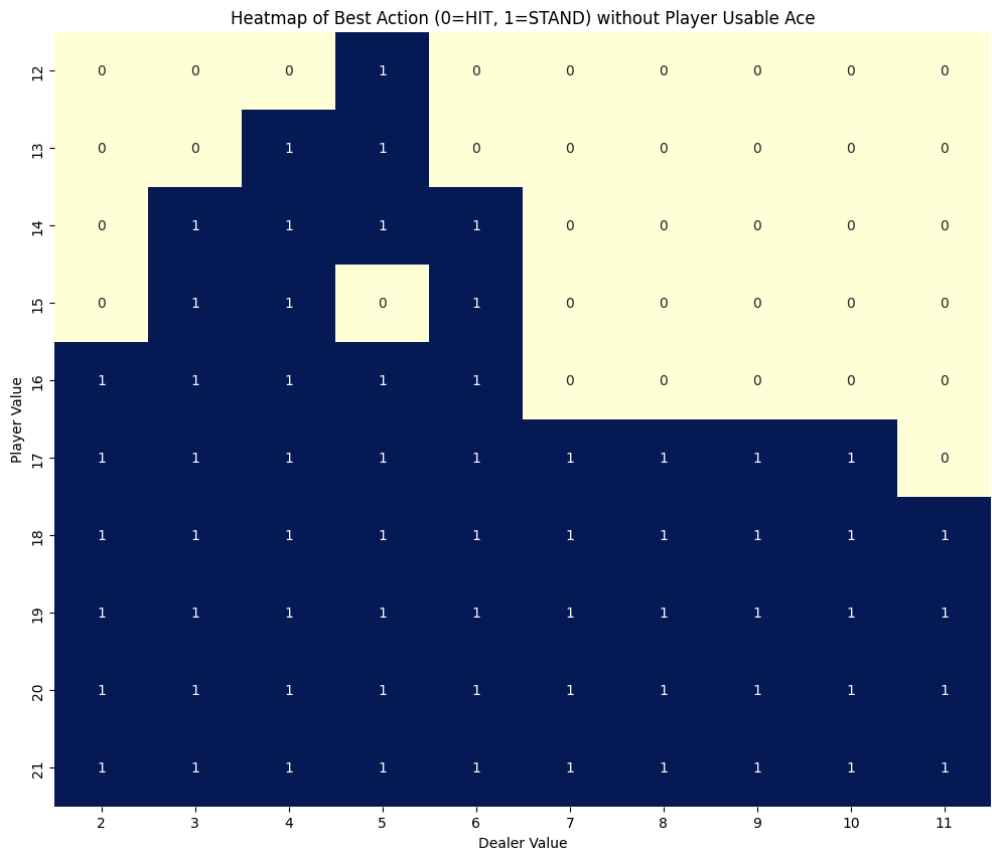
3) Strategy obtained from observing the values of the dealer and player as well as whether they have a usable ace or not

- highest reward achieved
- when the player has a usable ace we can see that they are more likely to hit and play more aggressive



./2025-02-26-1740559842920.png

- when the player does not have a usable ace they play more conservatively



./2025-02-26-1740559907416.png

- **Output**

Avg reward after 10000 games = -0.27517248275172485
Avg reward after 20000 games = -0.1977401129943503
Avg reward after 30000 games = -0.16729442351921603
Avg reward after 40000 games = -0.14604634884127896
Avg reward after 50000 games = -0.13065738685226294
Avg reward after 60000 games = -0.11891468475525407
Avg reward after 70000 games = -0.10988414451222125
Avg reward after 80000 games = -0.10414869814127324
Avg reward after 90000 games = -0.09914334285174609
Avg reward after 100000 games = -0.09671903280967191
Avg reward after 110000 games = -0.09365369405732675
Avg reward after 120000 games = -0.08861592820059833
Avg reward after 130000 games = -0.08492242367366405
Avg reward after 140000 games = -0.0827851229634074
Avg reward after 150000 games = -0.08132612449250338
Avg reward after 160000 games = -0.0791807551202805
Avg reward after 170000 games = -0.07819365768436656
Avg reward after 180000 games = -0.07767734623696534
Avg reward after 190000 games = -0.07757327593012668
Avg reward after 200000 games = -0.07704461477692612
Avg reward after 210000 games = -0.07621392279084385
Avg reward after 220000 games = -0.07537238467097877
Avg reward after 230000 games = -0.07461706688231791
Avg reward after 240000 games = -0.07420802413323278
Avg reward after 250000 games = -0.07410770356918572
Avg reward after 260000 games = -0.07375740862535145
Avg reward after 270000 games = -0.07340343183914133
Avg reward after 280000 games = -0.07254259806214977
Avg reward after 290000 games = -0.07254457743249161
Avg reward after 300000 games = -0.07228309238969204
Avg reward after 310000 games = -0.0718320263483021
Avg reward after 320000 games = -0.07126540229561783
Avg reward after 330000 games = -0.07121190541846843
Avg reward after 340000 games = -0.07074979191237672
Avg reward after 350000 games = -0.07061979822914792
Avg reward after 360000 games = -0.07032758242338216
Avg reward after 370000 games = -0.07025116148334734
Avg reward after 380000 games = -0.07019718369162187
Avg reward after 390000 games = -0.06949469360334974

Avg reward after 400000 games = -0.06910982722543194
Avg reward after 410000 games = -0.06878763710332414
Avg reward after 420000 games = -0.06836412294256443
Avg reward after 430000 games = -0.06816030660393813
Avg reward after 440000 games = -0.06780893679787091
Avg reward after 450000 games = -0.06756651651885218
Avg reward after 460000 games = -0.06747159245305988
Avg reward after 470000 games = -0.0673551758400514
Avg reward after 480000 games = -0.06734985968779232
Avg reward after 490000 games = -0.06691210834263603
Avg reward after 500000 games = -0.06649786700426599
Avg reward after 510000 games = -0.06640379136511497
Avg reward after 520000 games = -0.06643641069921019
Avg reward after 530000 games = -0.0662847805947536
Avg reward after 540000 games = -0.06633321049405463
Avg reward after 550000 games = -0.0660816980332763
Avg reward after 560000 games = -0.0660320249428126
Avg reward after 570000 games = -0.06587707740863613
Avg reward after 580000 games = -0.06570333499425
Avg reward after 590000 games = -0.0656473463604299
Avg reward after 600000 games = -0.06532155779740367
Avg reward after 610000 games = -0.06526546677792332
Avg reward after 620000 games = -0.06537247520568515
Avg reward after 630000 games = -0.0650459284985262
Avg reward after 640000 games = -0.06482802370621296
Avg reward after 650000 games = -0.06477836187944326
Avg reward after 660000 games = -0.06441050846892656
Avg reward after 670000 games = -0.06432229205628051
Avg reward after 680000 games = -0.06413225862903142
Avg reward after 690000 games = -0.06373903805936514
Avg reward after 700000 games = -0.06370419470829328
Avg reward after 710000 games = -0.06391117758989072
Avg reward after 720000 games = -0.0638638001891664
Avg reward after 730000 games = -0.06352868009769849
Avg reward after 740000 games = -0.0634782925969019
Avg reward after 750000 games = -0.06346658204455727
Avg reward after 760000 games = -0.06370254775980558
Avg reward after 770000 games = -0.06357264471085103
Avg reward after 780000 games = -0.06355632877393746
Avg reward after 790000 games = -0.06373915982384833

Avg reward after 800000 games = -0.063683670395412
Avg reward after 810000 games = -0.06358881038418471
Avg reward after 820000 games = -0.06383650751645426
Avg reward after 830000 games = -0.06361317636966703
Avg reward after 840000 games = -0.0634380197166432
Avg reward after 850000 games = -0.06327992555302876
Avg reward after 860000 games = -0.06334643796925818
Avg reward after 870000 games = -0.06334705362407629
Avg reward after 880000 games = -0.06321470089238534
Avg reward after 890000 games = -0.06326959183191928
Avg reward after 900000 games = -0.06331770742476953
Avg reward after 910000 games = -0.06329663373996293
Avg reward after 920000 games = -0.06308797490437511
Avg reward after 930000 games = -0.06302358814667941
Avg reward after 940000 games = -0.06290950754307709
Avg reward after 950000 games = -0.0627083550438368
Avg reward after 960000 games = -0.06269368469407845
Avg reward after 970000 games = -0.06276179096722581
Avg reward after 980000 games = -0.06266320136408024
Avg reward after 990000 games = -0.06269488616678165
Avg reward after 1000000 games = -0.06254393745606254

Learned Q-Table:

State (PlayerValue, DealerValue, hasUsableAcePlayer, hasUsableAceDealer) | Q(HIT) |
Q(STAND)

20,10,false,false | -0.988 | 0.603
15,9,false,false | -0.375 | -0.908
20,7,true,false | 0.101 | 0.815
15,7,false,false | -0.469 | -0.893
15,8,false,false | -0.111 | -0.921
14,9,true,false | -0.231 | -0.339
15,6,false,false | -0.886 | -0.128
18,6,true,false | 0.104 | -0.124
15,3,false,false | -0.764 | -0.220
15,4,false,false | -0.749 | -0.055
12,10,true,false | -0.152 | -0.412
17,10,true,false | -0.306 | -0.578

15,5,false,false | -0.732 | -0.863
15,2,true,false | -0.156 | -0.517
15,2,false,false | -0.542 | -0.866
19,11,false,true | -0.820 | 0.332
14,3,true,false | -0.021 | -0.276
21,10,true,false | -0.066 | 0.896
14,11,false,true | -0.594 | -0.933
13,3,true,false | -0.120 | -0.414
13,4,true,false | 0.096 | -0.230
12,4,true,false | 0.002 | -0.062
19,5,true,false | 0.042 | -0.149
14,11,true,true | -0.289 | -0.548
13,11,true,true | -0.416 | -0.561
12,5,true,false | -0.018 | -0.182
21,10,false,false | -1.000 | 0.896
20,8,false,false | -0.903 | 0.945
20,9,false,false | -0.839 | 0.912
20,4,false,false | -0.988 | 0.426
14,9,false,false | -0.269 | -0.933
14,8,false,false | -0.542 | -0.840
20,3,false,false | -0.766 | 0.870
20,5,false,false | -0.703 | 0.719
14,7,false,false | -0.591 | -0.709
16,7,true,false | -0.085 | -0.565
14,4,false,false | -0.819 | -0.007
14,5,false,false | -0.715 | 0.070
20,7,false,false | -0.873 | 0.749
20,6,false,false | -0.990 | 0.325
14,6,false,false | -0.790 | 0.036
20,6,true,false | 0.358 | 0.152
14,3,false,false | -0.821 | -0.668
18,10,true,false | -0.131 | -0.495
16,8,true,false | -0.257 | -0.425
20,2,false,false | -0.950 | 0.557
15,10,false,false | -0.355 | -0.911
14,2,false,false | -0.196 | -0.841
14,8,true,false | 0.169 | -0.283
15,11,false,true | -0.547 | -0.940
17,8,true,false | 0.032 | -0.413
16,10,false,false | -0.688 | -0.899

17,2,true,false | -0.148 | -0.317
12,9,true,false | -0.062 | -0.469
13,10,false,false | -0.203 | -0.839
20,10,true,false | -0.206 | 0.424
16,6,true,false | 0.044 | -0.337
12,6,true,false | 0.110 | -0.278
13,2,true,false | 0.071 | -0.271
18,7,true,false | -0.100 | -0.137
19,10,false,false | -0.841 | 0.106
19,7,true,false | 0.017 | 0.589
19,8,false,false | -0.636 | 0.643
15,3,true,false | 0.045 | -0.404
20,8,true,false | 0.065 | 0.740
16,8,false,false | -0.599 | -0.968
16,6,false,false | -0.802 | -0.031
16,2,false,false | -0.893 | -0.269
16,4,false,false | -0.890 | -0.271
18,5,true,false | 0.044 | -0.133
18,4,false,false | -0.515 | 0.340
13,11,false,true | -0.552 | -0.842
18,8,false,false | -0.658 | 0.287
12,10,false,false | -0.445 | -0.846
21,7,true,false | 0.479 | 0.843
15,9,true,false | -0.338 | -0.399
16,2,true,false | -0.040 | -0.415
18,2,false,false | -0.778 | 0.114
17,6,true,false | 0.195 | -0.261
17,6,false,false | -0.782 | 0.593
20,11,true,true | -0.485 | -0.172
12,11,false,true | -0.506 | -0.829
12,2,true,false | -0.027 | -0.197
17,4,false,false | -0.629 | 0.574
13,6,true,false | -0.213 | -0.170
19,6,false,false | -0.626 | 0.631
21,5,true,false | 0.427 | 0.792
19,4,false,false | -0.966 | 0.493
15,7,true,false | 0.075 | -0.301
17,8,false,false | -0.897 | -0.476
19,2,false,false | -0.794 | 0.292
18,6,false,false | -0.597 | 0.216

13,8,true,false | -0.016 | -0.344
19,9,true,false | -0.082 | -0.287
15,5,true,false | -0.001 | -0.420
19,2,true,false | -0.197 | 0.013
19,8,true,false | -0.135 | 0.339
21,3,true,false | 0.169 | 0.923
20,4,true,false | 0.013 | 0.224
18,3,true,false | -0.135 | -0.252
21,11,true,true | -0.009 | 0.631
14,6,true,false | -0.031 | -0.376
12,3,false,false | -0.254 | -0.689
15,10,true,false | -0.217 | -0.832
12,5,false,false | -0.509 | 0.043
17,3,false,false | -0.838 | -0.244
12,6,false,false | -0.295 | -0.749
12,2,false,false | -0.480 | -0.818
17,2,false,false | -0.840 | -0.300
17,11,true,true | -0.558 | -0.678
20,11,false,true | -0.846 | 0.107
18,11,true,true | -0.288 | -0.600
21,9,true,false | -0.004 | 0.841
18,10,false,false | -0.817 | -0.165
17,4,true,false | 0.059 | -0.260
12,4,false,false | -0.248 | -0.802
16,4,true,false | -0.007 | -0.312
13,6,false,false | -0.328 | -0.687
21,7,false,false | -0.962 | 0.919
21,11,false,true | -0.984 | 0.639
16,5,true,false | 0.029 | -0.376
21,8,false,false | -0.962 | 0.999
14,5,true,false | 0.073 | -0.344
21,6,false,false | -0.815 | 0.952
20,3,true,false | -0.025 | 0.402
21,5,false,false | -0.865 | 0.895
21,9,false,false | -0.977 | 0.999
12,8,true,false | -0.001 | -0.344
13,3,false,false | -0.271 | -0.835
13,7,false,false | -0.091 | -0.846
13,4,false,false | -0.686 | 0.122
18,8,true,false | 0.088 | -0.213

13,5,false,false | -0.630 | -0.130
12,9,false,false | -0.751 | -0.764
17,11,false,true | -0.679 | -0.969
13,2,false,false | -0.235 | -0.785
21,3,false,false | -0.686 | 0.899
12,7,false,false | -0.222 | -0.791
19,10,true,false | -0.134 | -0.439
17,3,true,false | -0.033 | -0.304
21,2,false,false | -0.891 | 0.730
21,4,false,false | -0.935 | 0.946
19,3,true,false | 0.073 | -0.339
12,8,false,false | -0.292 | -0.793
17,10,false,false | -0.901 | -0.653
20,5,true,false | -0.031 | 0.778
14,7,true,false | 0.011 | -0.184
12,7,true,false | 0.072 | -0.164
16,11,false,true | -0.587 | -0.962
16,9,true,false | -0.240 | -0.568
18,9,true,false | -0.226 | -0.520
13,8,false,false | -0.281 | -0.856
13,9,false,false | -0.226 | -0.828
17,5,true,false | -0.050 | -0.309
16,10,true,false | -0.184 | -0.664
13,5,true,false | 0.184 | -0.143
16,9,false,false | -0.364 | -0.927
21,8,true,false | 0.035 | 0.884
16,3,true,false | -0.027 | -0.397
12,3,true,false | -0.095 | -0.190
19,7,false,false | -0.837 | 0.448
19,9,false,false | -0.765 | 0.293
19,4,true,false | 0.118 | -0.232
19,11,true,true | -0.236 | -0.552
16,7,false,false | -0.394 | -0.934
18,4,true,false | 0.120 | -0.254
19,6,true,false | 0.199 | -0.050
12,11,true,true | -0.300 | -0.463
14,4,true,false | 0.069 | -0.328
20,9,true,false | -0.024 | 0.531
16,5,false,false | -0.771 | -0.442
15,4,true,false | -0.070 | -0.273

16,11,true,true | -0.290 | -0.613
21,2,true,false | 0.135 | 0.986
15,11,true,true | -0.402 | -0.580
18,11,false,true | -0.942 | -0.404
20,2,true,false | 0.187 | 0.438
16,3,false,false | -0.910 | -0.425
14,10,true,false | -0.216 | -0.564
18,7,false,false | -0.302 | 0.222
18,3,false,false | -0.820 | 0.051
18,2,true,false | -0.110 | -0.410
18,9,false,false | -0.854 | -0.291
13,9,true,false | 0.089 | -0.410
17,7,false,false | -0.747 | -0.136
15,6,true,false | -0.019 | -0.310
15,6,true,false | -0.019 | -0.310
17,5,false,false | -0.644 | -0.234
14,2,true,false | 0.042 | -0.321
21,4,true,false | 0.040 | 0.945
14,10,false,false | -0.429 | -0.916
19,5,false,false | -0.759 | 0.345
17,7,true,false | 0.185 | -0.343
13,7,true,false | 0.063 | -0.195
19,3,false,false | -0.952 | 0.281
17,9,false,false | -0.889 | -0.149
21,6,true,false | 0.439 | 0.837
17,9,true,false | -0.206 | -0.446
13,10,true,false | -0.183 | -0.586
15,8,true,false | 0.105 | -0.522
18,5,false,false | -0.785 | 0.009