Robert Roche

CS 481 HW 4

Write up

1.)

i. answer is on the page below

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Start | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | S12 | S13 | S14 | S15 | S16 | S17 | S18 | S19 | S20 | Bust |
| start | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 4 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| S12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 |  |  |  |  |  |  |  |  | 0 |
| S13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |  |  |  |  |  |  | 0 |
| S14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 |  |  |  |  |  |  | 0 |
| S15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 |
| S16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  |  |  |  | 0 |
| S17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 | 1 |  |  |  | 0 |
| S18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  |  | 0 |
| S19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  | 0 |
| S20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| bust | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |

ii.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Start state | 17 | 18 | 19 | 20 | 21 | S17 | S18 | S19 | S20 | BUST |
| 7 | 4/13 | 0 | 0 | 0 | 0 | 0 | 1/13 | 0 | 0 | 0 |
| 8 | 1/13 | 4/13 | 0 | 0 | 0 | 0 | 0 | 1/13 | 0 | 0 |
| 9 | 1/13 | 1/13 | 4/13 | 0 | 0 | 0 | 0 | 0 | 1/13 | 0 |
| 10 | 1/13 | 1/13 | 1/13 | 4/13 | 1/13 | 0 | 0 | 0 | 0 | 0 |
| 11 | 1/13 | 1/13 | 1/13 | 1/13 | 1/13 | 0 | 0 | 0 | 0 | 0 |
| 12 | 1/13 | 1/13 | 1/13 | 1/13 | 1/13 | 0 | 0 | 0 | 0 | 1/13 |
| 13 | 1/13 | 1/13 | 1/13 | 1/13 | 1/13 | 0 | 0 | 0 | 0 | 2/13 |
| 14 | 1/13 | 1/13 | 1/13 | 1/13 | 1/13 | 0 | 0 | 0 | 0 | 3/13 |
| 15 | 1/13 | 1/13 | 1/13 | 1/13 | 1/13 | 0 | 0 | 0 | 0 | 4/13 |
| 16 | 1/13 | 1/13 | 1/13 | 1/13 | 1/13 | 0 | 0 | 0 | 0 | 5/13 |
| 17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |

iii.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 17 | 18 | 19 | 20 | 21 | BUST |
| 0.194 | 0.19 | 0.187 | 0.24 | 0.05 | 0.15 |

Policy Explanation:

To come up with this policy I used some code from older assignments to simulate games. I simulated games of blackjack testing out some policies and found the one I included in the file to be what was best at the time of testing. It is similar to the dealers but hits and most of the soft numbers since they can be switched to smaller numbers in the event that the draw is high.