|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Single Q-Learning | | | | | | | |
| Combination | Mean | S.T.D. | Median | I.Q.R. | Max | Min | Failed |
| None | | | | | | | |
| - | 257.27 | 14.94 | 256.0 | 25.0 | 288 | 235 | 0 |
| One | | | | | | | |
| G | 237.03 | 12.74 | 236.0 | 17.0 | 269 | 217 | 0 |
| R | 253.70 | 12.99 | 252.5 | 18.0 | 299 | 236 | 0 |
| T | 255.83 | 15.63 | 254.5 | 19.0 | 290 | 229 | 1 |
| D | 257.97 | 15.28 | 259.0 | 21.0 | 294 | 230 | 0 |
| O | - | - | - | - | - | - | - |
| Two | | | | | | | |
| G + R | 235.03 | 10.96 | 234.5 | 17.0 | 255 | 216 | 0 |
| G + T | 227.10 | 8.88 | 225.0 | 11.0 | 250 | 213 | 0 |
| G + D | 231.80 | 14.55 | 227.5 | 11.0 | 273 | 211 | 0 |
| G + O | 256.23 | 12.85 | 252.0 | 16.0 | 287 | 239 | 0 |
| Three | | | | | | | |
| G + T + R | 231.30 | 11.35 | 230.5 | 10.0 | 263 | 211 | 0 |
| G + T + D | 230.97 | 11.39 | 228.0 | 18.0 | 262 | 209 | 0 |
| G + T + O | 247.07 | 7.76 | 246.0 | 13.0 | 265 | 236 | 2 |
| G + R + D | 234.10 | 11.31 | 233.5 | 17.0 | 257 | 217 | 0 |
| G + R + O | 248.83 | 9.64 | 249.5 | 10.0 | 283 | 231 | 0 |
| G + D + O | 250.83 | 12.31 | 252.0 | 18.0 | 278 | 228 | 0 |
| Four | | | | | | | |
| G + T + R + D | 232.60 | 12.19 | 230.0 | 23.0 | 252 | 213 | 0 |
| G + T + R + O | 246.67 | 9.31 | 245.0 | 11.0 | 269 | 229 | 2 |
| G + T + D + O | 250.87 | 11.53 | 249.5 | 13.0 | 292 | 237 | 0 |
| G + R + D + O | 249.63 | 8.19 | 251.0 | 11.0 | 268 | 236 | 0 |
| Five | | | | | | | |
| G + T + R + D + O | 248.90 | 8.88 | 249.0 | 7.0 | 280 | 230 | 0 |

**Granularity – G, Random – R, Termination – T, Opposition – O, Discount – D**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Single Q-Learning | | | | | | | |
| Combination | Mean | S.T.D. | Median | I.Q.R. | Max | Min | Failed |
| None | | | | | | | |
| - | 257.27 | 14.94 | 256.0 | 25.0 | 288 | 235 | 0 |
| One | | | | | | | |
| G | 237.03 | 12.74 | 236.0 | 17.0 | 269 | 217 | 0 |
| R | 253.70 | 12.99 | 252.5 | 18.0 | 299 | 236 | 0 |
| T | 255.83 | 15.63 | 254.5 | 19.0 | 290 | 229 | 1 |
| D | 257.97 | 15.28 | 259.0 | 21.0 | 294 | 230 | 0 |
| O | - | - | - | - | - | - | - |
| Two | | | | | | | |
| G + R | 235.03 | 10.96 | 234.5 | 17.0 | 255 | 216 | 0 |
| G + T | 227.10 | 8.88 | 225.0 | 11.0 | 250 | 213 | 0 |
| G + D | 231.80 | 14.55 | 227.5 | 11.0 | 273 | 211 | 0 |
| G + O | 256.23 | 12.85 | 252.0 | 16.0 | 287 | 239 | 0 |
| Three | | | | | | | |
| G + T + R | 231.30 | 11.35 | 230.5 | 10.0 | 263 | 211 | 0 |
| G + T + D | 230.97 | 11.39 | 228.0 | 18.0 | 262 | 209 | 0 |
| G + T + O | 247.07 | 7.76 | 246.0 | 13.0 | 265 | 236 | 2 |
| G + R + D | 234.10 | 11.31 | 233.5 | 17.0 | 257 | 217 | 0 |
| G + R + O | 248.83 | 9.64 | 249.5 | 10.0 | 283 | 231 | 0 |
| G + D + O | 250.83 | 12.31 | 252.0 | 18.0 | 278 | 228 | 0 |
| Four | | | | | | | |
| G + T + R + D | 232.60 | 12.19 | 230.0 | 23.0 | 252 | 213 | 0 |
| G + T + R + O | 246.67 | 9.31 | 245.0 | 11.0 | 269 | 229 | 2 |
| G + T + D + O | 250.87 | 11.53 | 249.5 | 13.0 | 292 | 237 | 0 |
| G + R + D + O | 249.63 | 8.19 | 251.0 | 11.0 | 268 | 236 | 0 |
| Five | | | | | | | |
| G + T + R + D + O | 248.90 | 8.88 | 249.0 | 7.0 | 280 | 230 | 0 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Double Q-Learning | | | | | | | |
| Combination | Mean | S.T.D. | Median | I.Q.R. | Max | Min | Failed |
| None | | | | | | | |
| - | 254.90 | 19.99 | 252.5 | 29.0 | 303 | 223 | 1 |
| One | | | | | | | |
| G | 230.03 | 16.98 | 224.5 | 23.0 | 275 | 206 | 1 |
| R | 252.77 | 19.85 | 251.0 | 25.0 | 328 | 221 | 0 |
| T | 253.07 | 14.88 | 251.0 | 23.0 | 292 | 233 | 0 |
| D | 249.83 | 17.32 | 252.0 | 22.0 | 296 | 215 | 4 |
| O | - | - | - | - | - | - | - |
| Two | | | | | | | |
| G + R | 231.23 | 14.88 | 233.5 | 20.0 | 265 | 205 | 0 |
| G + T | 223.67 | 15.81 | 221.0 | 23.0 | 269 | 200 | 0 |
| G + D | 228.27 | 14.40 | 228.5 | 20.0 | 273 | 206 | 0 |
| G + O | 243.77 | 17.88 | 239.0 | 24.0 | 299 | 221 | 0 |
| Three | | | | | | | |
| G + T + R |  |  |  |  |  |  |  |
| G + T + D |  |  |  |  |  |  |  |
| G + T + O |  |  |  |  |  |  |  |
| G + R + D |  |  |  |  |  |  |  |
| G + R + O |  |  |  |  |  |  |  |
| G + D + O |  |  |  |  |  |  |  |
| Four | | | | | | | |
| G + T + R + D |  |  |  |  |  |  |  |
| G + T + R + O |  |  |  |  |  |  |  |
| G + T + D + O |  |  |  |  |  |  |  |
| G + R + D + O |  |  |  |  |  |  |  |
| Five | | | | | | | |
| G + T + R + D + O |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Triple Q-Learning | | | | | | | |
| Combination | Mean | S.T.D. | Median | I.Q.R. | Max | Min | Failed |
| None | | | | | | | |
| - |  |  |  |  |  |  |  |
| One | | | | | | | |
| G |  |  |  |  |  |  |  |
| R |  |  |  |  |  |  |  |
| T |  |  |  |  |  |  |  |
| D |  |  |  |  |  |  |  |
| O |  |  |  |  |  |  |  |
| Two | | | | | | | |
| G + R |  |  |  |  |  |  |  |
| G + T |  |  |  |  |  |  |  |
| G + D |  |  |  |  |  |  |  |
| G + O |  |  |  |  |  |  |  |
| Three | | | | | | | |
| G + T + R |  |  |  |  |  |  |  |
| G + T + D |  |  |  |  |  |  |  |
| G + T + O |  |  |  |  |  |  |  |
| G + R + D |  |  |  |  |  |  |  |
| G + R + O |  |  |  |  |  |  |  |
| G + D + O |  |  |  |  |  |  |  |
| Four | | | | | | | |
| G + T + R + D |  |  |  |  |  |  |  |
| G + T + R + O |  |  |  |  |  |  |  |
| G + T + D + O |  |  |  |  |  |  |  |
| G + R + D + O |  |  |  |  |  |  |  |
| Five | | | | | | | |
| G + T + R + D + O |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Quadruple Q-Learning | | | | | | | |
| Combination | Mean | S.T.D. | Median | I.Q.R. | Max | Min | Failed |
| None | | | | | | | |
| - |  |  |  |  |  |  |  |
| One | | | | | | | |
| G |  |  |  |  |  |  |  |
| R |  |  |  |  |  |  |  |
| T |  |  |  |  |  |  |  |
| D |  |  |  |  |  |  |  |
| O |  |  |  |  |  |  |  |
| Two | | | | | | | |
| G + R |  |  |  |  |  |  |  |
| G + T |  |  |  |  |  |  |  |
| G + D |  |  |  |  |  |  |  |
| G + O |  |  |  |  |  |  |  |
| Three | | | | | | | |
| G + T + R |  |  |  |  |  |  |  |
| G + T + D |  |  |  |  |  |  |  |
| G + T + O |  |  |  |  |  |  |  |
| G + R + D |  |  |  |  |  |  |  |
| G + R + O |  |  |  |  |  |  |  |
| G + D + O |  |  |  |  |  |  |  |
| Four | | | | | | | |
| G + T + R + D |  |  |  |  |  |  |  |
| G + T + R + O |  |  |  |  |  |  |  |
| G + T + D + O |  |  |  |  |  |  |  |
| G + R + D + O |  |  |  |  |  |  |  |
| Five | | | | | | | |
| G + T + R + D + O |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Quintuple Q-Learning | | | | | | | |
| Combination | Mean | S.T.D. | Median | I.Q.R. | Max | Min | Failed |
| None | | | | | | | |
| - |  |  |  |  |  |  |  |
| One | | | | | | | |
| G |  |  |  |  |  |  |  |
| R |  |  |  |  |  |  |  |
| T |  |  |  |  |  |  |  |
| D |  |  |  |  |  |  |  |
| O |  |  |  |  |  |  |  |
| Two | | | | | | | |
| G + R |  |  |  |  |  |  |  |
| G + T |  |  |  |  |  |  |  |
| G + D |  |  |  |  |  |  |  |
| G + O |  |  |  |  |  |  |  |
| Three | | | | | | | |
| G + T + R |  |  |  |  |  |  |  |
| G + T + D |  |  |  |  |  |  |  |
| G + T + O |  |  |  |  |  |  |  |
| G + R + D |  |  |  |  |  |  |  |
| G + R + O |  |  |  |  |  |  |  |
| G + D + O |  |  |  |  |  |  |  |
| Four | | | | | | | |
| G + T + R + D |  |  |  |  |  |  |  |
| G + T + R + O |  |  |  |  |  |  |  |
| G + T + D + O |  |  |  |  |  |  |  |
| G + R + D + O |  |  |  |  |  |  |  |
| Five | | | | | | | |
| G + T + R + D + O |  |  |  |  |  |  |  |