|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Single Q-Learning | | | | | | | | |
| Combination | Mean | S.T.D | Median | I.Q.R | Max | Min | Failed | Difference |
| - | | | | | | | | |
| Termination | 256.90 | 17.24 | 252.5 | 17.0 | 309 | 233 | 1 | 0 |
| Original | 257.27 | 14.94 | 256.0 | 25.0 | 288 | 235 | 0 | 0 |
| Logarithmic | 257.70 | 13.68 | 254.0 | 22.0 | 288 | 228 | 2 | 0 |
| Uniform | 258.93 | 14.02 | 262.5 | 20.0 | 287 | 231 | 0 | 0 |
| Time Penalty | 259.47 | 14.61 | 256.5 | 21.0 | 298 | 242 | 0 | 0 |
| Time | 263.07 | 14.03 | 259.5 | 16.0 | 293 | 235 | 0 | 0 |
| Exponential | 265.43 | 18.49 | 265.5 | 28.0 | 310 | 230 | 1 | 0 |
| G | | | | | | | | |
| Termination | 231.27 | 14.10 | 229.0 | 12.0 | 268 | 213 | 0 | 17.03 |
| Time Penalty | 232.87 | 13.44 | 232.5 | 17.0 | 267 | 211 | 1 | 15.62 |
| Time | 233.80 | 13.44 | 233.0 | 18.0 | 278 | 214 | 0 | 14.69 |
| Exponential | 234.50 | 12.40 | 235.0 | 15.0 | 263 | 212 | 0 | 14.29 |
| Logarithmic | 233.23 | 17.75 | 230.5 | 33.0 | 267 | 210 | 0 | 13.90 |
| Original | 237.03 | 12.74 | 236.0 | 17.0 | 269 | 217 | 0 | 11.66 |
| Uniform | 237.47 | 17.54 | 237.0 | 17.0 | 312 | 215 | 0 | 9.74 |
| G + R | | | | | | | | |
| Exponential | 229.00 | 12.64 | 227.0 | 17.0 | 269 | 212 | 0 | 19.72 |
| Original | 231.10 | 9.32 | 231.5 | 12.0 | 250 | 216 | 0 | 18.48 |
| Termination | 230.70 | 11.56 | 227.0 | 17.0 | 257 | 212 | 0 | 18.32 |
| Time | 232.97 | 11.81 | 235.0 | 19.0 | 259 | 215 | 0 | 15.98 |
| Uniform | 233.43 | 14.10 | 232.0 | 15.0 | 269 | 209 | 0 | 14.86 |
| Time Penalty | 234.27 | 17.46 | 230.0 | 24.0 | 291 | 211 | 0 | 12.96 |
| Logarithmic | 236.27 | 16.21 | 232.0 | 18.0 | 282 | 213 | 0 | 11.38 |
| G + D + R | | | | | | | | |
| Uniform | 231.83 | 13.58 | 230.5 | 17.0 | 262 | 203 | 0 | 16.62 |
| Termination | 232.20 | 12.31 | 231.0 | 23.0 | 253 | 211 | 0 | 16.61 |
| Time Penalty | 234.10 | 13.48 | 232.5 | 12.0 | 265 | 210 | 0 | 14.38 |
| Original | 234.57 | 13.34 | 232.0 | 17.0 | 268 | 216 | 0 | 13.95 |
| Exponential | 235.13 | 12.39 | 232.0 | 20.0 | 258 | 214 | 0 | 13.66 |
| Logarithmic | 236.13 | 16.68 | 232.5 | 22.0 | 279 | 211 | 0 | 11.36 |
| Time | 238.70 | 13.00 | 234.5 | 18.0 | 274 | 225 | 0 | 9.92 |
| G + O + D + R | | | | | | | | |
| Exponential | 237.30 | 7.58 | 238.5 | 11.0 | 253 | 224 | 0 | 12.65 |
| Logarithmic | 238.00 | 7.71 | 237.5 | 12.0 | 253 | 220 | 0 | 11.93 |
| Uniform | 239.53 | 9.50 | 237.5 | 10.0 | 265 | 221 | 0 | 10.00 |
| Termination | 246.00 | 9.43 | 245.0 | 15.0 | 262 | 231 | 0 | 3.55 |
| Original | 247.80 | 7.06 | 247.0 | 12.0 | 261 | 237 | 0 | 2.25 |
| Time Penalty | 254.40 | 11.84 | 253.5 | 17.0 | 282 | 233 | 4 | 0 |
| Time | 256.67 | 10.50 | 254.5 | 15.0 | 278 | 241 | 3 | 0 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Double Q-Learning | | | | | | | | |
| Combination | Mean | S.T.D | Median | I.Q.R | Max | Min | Failed | Difference |
| - | | | | | | | | |
| Exponential | 249.73 | 14.71 | 247.5 | 20.0 | 285 | 223 | 0 | 0 |
| Time Penalty | 250.00 | 14.86 | 248.0 | 22.0 | 282 | 230 | 2 | 0 |
| Logarithmic | 251.20 | 19.17 | 247.5 | 22.0 | 300 | 222 | 0 | 0 |
| Termination | 252.10 | 20.25 | 247.0 | 29.0 | 319 | 222 | 3 | 0 |
| Time | 252.17 | 15.92 | 248.0 | 16.0 | 292 | 225 | 5 | 0 |
| Original | 254.90 | 19.99 | 252.5 | 29.0 | 303 | 223 | 1 | 0 |
| Uniform | 260.43 | 26.31 | 254.0 | 34.0 | 325 | 225 | 0 | 0 |
| G | | | | | | | | |
| Uniform | 223.83 | 13.51 | 224.0 | 17.0 | 255 | 203 | 0 | 24.64 |
| Exponential | 224.60 | 14.63 | 222.5 | 18.0 | 258 | 208 | 0 | 23.54 |
| Termination | 230.60 | 13.49 | 228.5 | 16.0 | 260 | 203 | 2 | 17.88 |
| Original | 230.03 | 16.98 | 224.5 | 23.0 | 275 | 206 | 1 | 17.36 |
| Time | 231.33 | 13.95 | 229.0 | 20.0 | 254 | 202 | 0 | 17.01 |
| Time Penalty | 230.97 | 19.39 | 226.0 | 20.0 | 297 | 210 | 0 | 15.61 |
| Logarithmic | 233.23 | 26.62 | 225.0 | 24.0 | 308 | 208 | 0 | 10.70 |
| G + D | | | | | | | | |
| Time Penalty | 225.00 | 17.02 | 218.0 | 17.0 | 278 | 206 | 0 | 22.38 |
| Exponential | 225.40 | 19.71 | 219.5 | 20.0 | 276 | 201 | 0 | 21.07 |
| Uniform | 226.73 | 18.56 | 220.0 | 24.0 | 277 | 202 | 0 | 20.13 |
| Logarithmic | 227.87 | 17.58 | 223.5 | 19.0 | 265 | 204 | 0 | 19.33 |
| Time | 227.97 | 19.94 | 221.5 | 29.0 | 297 | 203 | 0 | 18.42 |
| Original | 229.50 | 19.48 | 223.5 | 16.0 | 283 | 207 | 0 | 17.05 |
| Termination | 231.87 | 24.47 | 223.0 | 21.0 | 322 | 208 | 0 | 12.88 |
| G + D + R | | | | | | | | |
| Uniform | 226.50 | 14.31 | 225.0 | 19.0 | 276 | 208 | 0 | 21.73 |
| Time | 231.27 | 14.83 | 227.0 | 22.0 | 265 | 206 | 1 | 16.81 |
| Logarithmic | 230.50 | 18.93 | 231.0 | 27.0 | 292 | 202 | 0 | 16.24 |
| Original | 232.57 | 13.84 | 230.5 | 19.0 | 265 | 205 | 0 | 15.80 |
| Time Penalty | 233.70 | 16.99 | 233.0 | 25.0 | 270 | 206 | 0 | 13.69 |
| Exponential | 232.43 | 28.16 | 225.0 | 19.0 | 335 | 203 | 0 | 10.91 |
| Termination | 235.07 | 28.15 | 225.0 | 27.0 | 351 | 206 | 1 | 8.28 |
| G + O + D + R | | | | | | | | |
| Termination | 236.93 | 9.95 | 237.0 | 15.0 | 257 | 220 | 8 | 12.50 |
| Time Penalty | 237.97 | 16.15 | 232.0 | 23.0 | 275 | 218 | 5 | 9.69 |
| Uniform | 238.53 | 14.58 | 235.0 | 21.0 | 274 | 215 | 0 | 9.62 |
| Exponential | 239.40 | 11.92 | 238.0 | 22.0 | 262 | 223 | 0 | 9.52 |
| Logarithmic | 238.67 | 17.55 | 235.5 | 20.0 | 298 | 211 | 0 | 8.54 |
| Original | 245.97 | 13.43 | 244.5 | 18.0 | 285 | 228 | 0 | 2.53 |
| Time | 253.47 | 17.51 | 249.5 | 22.0 | 293 | 224 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Triple Q-Learning | | | | | | | | |
| Combination | Mean | S.T.D | Median | I.Q.R | Max | Min | Failed | Difference |
| - | | | | | | | | |
| Time Penalty | 235.13 | 15.73 | 232.5 | 16.0 | 278 | 216 | 0 | 12.66 |
| Logarithmic | 236.20 | 14.04 | 237.0 | 24.0 | 260 | 211 | 0 | 12.12 |
| Termination | 236.93 | 16.85 | 235.0 | 19.0 | 304 | 214 | 0 | 10.50 |
| Exponential | 237.63 | 15.66 | 233.5 | 22.0 | 269 | 215 | 0 | 10.18 |
| Original | 242.50 | 18.16 | 237.5 | 15.0 | 304 | 220 | 3 | 4.50 |
| Time | 244.13 | 16.85 | 243.0 | 29.0 | 279 | 215 | 0 | 3.30 |
| Uniform | 248.03 | 21.34 | 244.5 | 27.0 | 301 | 215 | 0 | 0 |
| G | | | | | | | | |
| Exponential | 213.47 | 7.91 | 213.0 | 10.0 | 228 | 196 | 0 | 36.42 |
| Logarithmic | 214.73 | 11.86 | 213.0 | 16.0 | 241 | 199 | 0 | 34.21 |
| Uniform | 215.50 | 10.78 | 214.5 | 11.0 | 243 | 199 | 0 | 33.72 |
| Original | 217.13 | 10.23 | 215.5 | 10.0 | 248 | 205 | 0 | 32.23 |
| Time Penalty | 219.30 | 12.59 | 217.0 | 18.0 | 246 | 201 | 0 | 29.44 |
| Termination | 220.77 | 12.16 | 220.5 | 17.0 | 239 | 196 | 0 | 28.09 |
| Time | 221.17 | 13.28 | 221.0 | 17.0 | 263 | 203 | 3 | 27.37 |
| G + R | | | | | | | | |
| Time Penalty | 217.13 | 11.68 | 213.5 | 18.0 | 246 | 198 | 0 | 31.86 |
| Exponential | 217.27 | 11.30 | 215.5 | 15.0 | 242 | 200 | 0 | 31.82 |
| Logarithmic | 217.77 | 11.05 | 215.0 | 15.0 | 239 | 198 | 0 | 31.39 |
| Original | 218.13 | 14.51 | 215.0 | 16.0 | 255 | 199 | 1 | 30.04 |
| Termination | 219.53 | 10.96 | 218.0 | 13.0 | 245 | 189 | 0 | 29.65 |
| Uniform | 219.87 | 10.34 | 220.0 | 15.0 | 238 | 202 | 0 | 29.47 |
| Time | 223.07 | 11.47 | 219.5 | 13.0 | 248 | 204 | 1 | 25.97 |
| G + O + D | | | | | | | | |
| Logarithmic | 215.00 | 12.00 | 214.5 | 12.0 | 257 | 198 | 0 | 33.90 |
| Exponential | 216.93 | 8.73 | 216.5 | 13.0 | 237 | 204 | 0 | 32.78 |
| Uniform | 216.90 | 10.52 | 217.0 | 13.0 | 242 | 200 | 0 | 32.39 |
| Termination | 219.20 | 8.04 | 219.0 | 11.0 | 237 | 207 | 0 | 30.66 |
| Time Penalty | 220.63 | 8.76 | 220.5 | 9.0 | 243 | 205 | 0 | 29.08 |
| Original | 221.77 | 5.95 | 221.5 | 7.0 | 236 | 209 | 0 | 28.48 |
| Time | 225.87 | 10.36 | 227.0 | 17.0 | 250 | 205 | 0 | 23.46 |
| G + O + D + R | | | | | | | | |
| Exponential | 214.93 | 10.32 | 212.0 | 15.0 | 234 | 198 | 0 | 34.40 |
| Logarithmic | 216.37 | 8.74 | 215.0 | 13.0 | 235 | 201 | 0 | 33.34 |
| Termination | 217.23 | 6.75 | 217.0 | 11.0 | 234 | 204 | 0 | 32.88 |
| Uniform | 217.50 | 9.61 | 217.0 | 13.0 | 237 | 195 | 0 | 32.01 |
| Time Penalty | 221.80 | 9.69 | 221.5 | 9.0 | 242 | 200 | 0 | 27.69 |
| Original | 224.40 | 9.05 | 227.0 | 14.0 | 238 | 206 | 0 | 25.24 |
| Time | 227.70 | 12.24 | 226.5 | 12.0 | 264 | 210 | 0 | 21.13 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quadruple Q-Learning | | | | | | | | |
| Combination | Mean | S.T.D | Median | I.Q.R | Max | Min | Failed | Difference |
| - | | | | | | | | |
| Termination | 226.73 | 11.93 | 224.5 | 20.0 | 253 | 208 | 0 | 22.19 |
| Logarithmic | 227.60 | 11.25 | 227.5 | 15.0 | 264 | 211 | 0 | 21.50 |
| Time Penalty | 226.77 | 18.24 | 222.0 | 18.0 | 290 | 203 | 0 | 20.20 |
| Uniform | 230.63 | 12.45 | 228.5 | 16.0 | 268 | 214 | 0 | 18.14 |
| Exponential | 233.43 | 14.66 | 231.5 | 21.0 | 268 | 203 | 0 | 14.69 |
| Original | 233.60 | 15.50 | 231.0 | 21.0 | 275 | 211 | 13 | 14.27 |
| Time | 236.97 | 16.11 | 233.5 | 18.0 | 295 | 217 | 16 | 10.70 |
| G | | | | | | | | |
| Uniform | 210.80 | 10.12 | 207.0 | 11.0 | 237 | 197 | 0 | 38.59 |
| Exponential | 212.53 | 8.31 | 212.5 | 11.0 | 235 | 198 | 0 | 37.27 |
| Logarithmic | 212.13 | 10.26 | 212.0 | 12.0 | 231 | 195 | 0 | 37.22 |
| Termination | 212.67 | 9.85 | 211.5 | 15.0 | 234 | 199 | 1 | 36.78 |
| Time Penalty | 215.80 | 13.47 | 214.5 | 15.0 | 252 | 193 | 3 | 32.68 |
| Original | 223.77 | 20.00 | 219.0 | 17.0 | 299 | 194 | 13 | 22.60 |
| Time | - | - | - | - | - | - | - | - |
| G + O | | | | | | | | |
| Uniform | 209.73 | 6.67 | 209.0 | 8.0 | 228 | 196 | 0 | 40.39 |
| Exponential | 210.73 | 6.95 | 212.0 | 10.0 | 223 | 196 | 0 | 39.34 |
| Logarithmic | 211.50 | 9.35 | 208.0 | 13.0 | 238 | 200 | 0 | 38.07 |
| Time Penalty | 214.20 | 6.42 | 214.0 | 9.0 | 230 | 200 | 1 | 35.97 |
| Termination | 215.23 | 8.72 | 213.0 | 8.0 | 241 | 201 | 0 | 34.48 |
| Original | 217.23 | 7.31 | 216.0 | 12.0 | 234 | 207 | 0 | 32.78 |
| Time | 220.83 | 7.13 | 221.5 | 8.0 | 237 | 205 | 0 | 29.21 |
| G + O + D | | | | | | | | |
| Uniform | 208.97 | 5.84 | 209.0 | 9.0 | 220 | 199 | 0 | 41.30 |
| Logarithmic | 210.20 | 9.50 | 208.5 | 12.0 | 236 | 197 | 0 | 39.34 |
| Exponential | 211.47 | 7.07 | 210.0 | 9.0 | 233 | 199 | 0 | 38.58 |
| Time Penalty | 213.30 | 7.38 | 212.0 | 8.0 | 231 | 202 | 1 | 36.69 |
| Termination | 214.03 | 7.04 | 213.5 | 8.0 | 231 | 200 | 0 | 36.03 |
| Original | 218.20 | 6.28 | 217.5 | 7.0 | 233 | 204 | 0 | 31.99 |
| Time | 222.67 | 11.39 | 221.0 | 13.0 | 258 | 204 | 0 | 26.40 |
| G + O + D + R | | | | | | | | |
| Logarithmic | 209.70 | 8.44 | 207.5 | 9.0 | 232 | 195 | 0 | 40.08 |
| Uniform | 210.23 | 6.93 | 210.0 | 10.0 | 225 | 201 | 0 | 39.84 |
| Exponential | 212.37 | 10.20 | 212.5 | 7.0 | 239 | 190 | 0 | 37.00 |
| Time Penalty | 216.20 | 6.62 | 216.0 | 7.0 | 229 | 202 | 0 | 33.93 |
| Termination | 216.37 | 9.82 | 216.0 | 13.0 | 247 | 200 | 0 | 33.09 |
| Original | 219.03 | 10.13 | 218.0 | 12.0 | 249 | 203 | 0 | 30.36 |
| Time | 224.77 | 13.01 | 222.5 | 21.0 | 266 | 207 | 0 | 23.85 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quintuple Q-Learning | | | | | | | | |
| Combination | Mean | S.T.D | Median | I.Q.R | Max | Min | Failed | Difference |
| - | | | | | | | | |
| Termination | 219.53 | 10.37 | 217.0 | 14.0 | 242 | 205 | 0 | 29.80 |
| Uniform | 223.60 | 9.16 | 223.5 | 9.0 | 243 | 198 | 0 | 26.01 |
| Time Penalty | 224.37 | 17.65 | 220.0 | 13.0 | 287 | 206 | 0 | 22.80 |
| Exponential | 228.37 | 13.07 | 227.0 | 19.0 | 252 | 202 | 0 | 20.23 |
| Logarithmic | 230.67 | 12.64 | 229.5 | 19.0 | 252 | 206 | 0 | 18.06 |
| Original | - | - | - | - | - | - | - | - |
| Time | - | - | - | - | - | - | - | - |
| O | | | | | | | | |
| Logarithmic | 241.17 | 10.73 | 238.5 | 16.0 | 263 | 224 | 0 | 8.07 |
| Exponential | 242.00 | 13.16 | 242.0 | 14.0 | 279 | 222 | 0 | 6.57 |
| Uniform | 242.83 | 11.81 | 242.0 | 14.0 | 271 | 225 | 0 | 6.12 |
| Termination | 252.13 | 10.63 | 255.0 | 14.0 | 271 | 228 | 0 | 0 |
| Original | 263.10 | 14.37 | 260.5 | 12.0 | 298 | 239 | 0 | 0 |
| Time | 272.50 | 18.85 | 269.0 | 23.0 | 319 | 243 | 0 | 0 |
| Time Penalty | 249.30 | 13.00 | 248.0 | 16.0 | 287 | 231 | 0 | 0 |
| G + O | | | | | | | | |
| Exponential | 209.17 | 8.57 | 206.0 | 12.0 | 233 | 196 | 0 | 40.58 |
| Termination | 209.57 | 6.85 | 209.0 | 9.0 | 225 | 196 | 0 | 40.52 |
| Logarithmic | 209.50 | 7.69 | 208.5 | 8.0 | 230 | 197 | 0 | 40.43 |
| Time Penalty | 212.67 | 9.63 | 210.0 | 11.0 | 247 | 199 | 0 | 36.84 |
| Uniform | 214.27 | 9.74 | 213.0 | 7.0 | 248 | 195 | 0 | 35.21 |
| Original | 215.53 | 7.88 | 214.0 | 11.0 | 231 | 199 | 0 | 34.36 |
| Time | 218.30 | 7.76 | 216.0 | 10.0 | 235 | 206 | 0 | 31.62 |
| G + O + R | | | | | | | | |
| Exponential | 209.57 | 6.85 | 210.5 | 9.0 | 223 | 194 | 0 | 40.52 |
| Logarithmic | 210.57 | 8.13 | 210.5 | 11.0 | 227 | 199 | 0 | 39.27 |
| Termination | 211.50 | 6.19 | 211.5 | 8.0 | 226 | 202 | 0 | 38.71 |
| Uniform | 211.27 | 9.10 | 212.0 | 13.0 | 228 | 190 | 0 | 38.36 |
| Time | 216.27 | 7.94 | 214.5 | 8.0 | 236 | 201 | 3 | 33.61 |
| Time Penalty | 216.57 | 9.22 | 214.0 | 10.0 | 246 | 202 | 0 | 33.04 |
| Original | 214.07 | 9.53 | 214.5 | 12.0 | 231 | 196 | 0 | 35.46 |
| G + O + D + R | | | | | | | | |
| Uniform | 209.20 | 8.24 | 209.5 | 13.0 | 232 | 198 | 0 | 40.62 |
| Exponential | 210.53 | 8.02 | 208.0 | 8.0 | 234 | 200 | 0 | 39.33 |
| Time Penalty | 211.00 | 7.55 | 211.0 | 10.0 | 230 | 200 | 2 | 38.96 |
| Termination | 212.23 | 8.39 | 213.5 | 17.0 | 224 | 199 | 0 | 37.56 |
| Logarithmic | 213.73 | 8.42 | 214.0 | 8.0 | 240 | 199 | 0 | 36.05 |
| Original | 217.07 | 6.33 | 216.5 | 9.0 | 231 | 208 | 0 | 33.11 |
| Time | 217.13 | 12.37 | 215.0 | 10.0 | 270 | 201 | 2 | 31.67 |