Table 1: Summary Statistics by Problem Family

Rate (%)   Value   Evals   Evals   (s)	Problem Family	Optimizer	Avg Success	Avg Final		Avg Grad	Avg Time
Aggressive	Пу		Rate (%)	Value	Evals	Evals	(s)
L.BFGS		Trust Region-	0.0	4.38e0	5.2	4.1	0.000
Conservative   GD-Nesterov   0.0   3.61e0   20.5   37.5   0.001   GD-Nesterov   0.0   3.60e0   28.0   52.0   0.001   WeightDecay   Adam-Fast   0.0   3.58e0   21.9   40.9   0.001   AdaptiveMomentum   Adam-   0.0   3.58e0   21.9   40.9   0.001   AdaptiveMomentum   Adam-   0.0   3.57e0   1055.6   1054.6   0.025   AMSGrad   Adam-   0.0   3.58e0   194.6   193.6   0.005   WeightDecay   Adam-   0.0   3.58e0   194.6   193.6   0.005   WeightDecay   Adam-   0.0   3.57e0   532.0   531.0   0.012   CD   CD   0.0   3.57e0   532.0   531.0   0.0012   CD   CD   CD   0.0   3.57e0   532.0   531.0   0.0012   CD   CD   CD   CD   CD   CD   CD   C		Aggressive					
GD-Nesterov   0.0   3.61e0   20.5   37.5   0.001		L-BFGS-	0.0	3.57e0	242.7	145.1	0.005
GD- 0.0 3.60e0 28.0 52.0 0.001 WeightDecay Adam-Fast 0.0 3.61e0 80.9 79.9 0.002 GD- 0.0 3.58e0 21.9 40.9 0.001 AdaptiveMomentum Adam- 0.0 3.57e0 1055.6 1054.6 0.025 AMSGrad Ackley Adam- 0.0 3.58e0 194.6 193.6 0.005 WeightDecay Adam- 0.0 3.58e0 76.2 75.2 0.002 GD-Momentum 0.0 3.58e0 76.2 75.2 0.002 GD-Momentum 0.0 3.57e0 532.0 531.0 0.012 GD 0.0 3.58e0 42.5 28.9 0.000 Precise Trust Region- 0.0 3.60e0 42.5 28.9 0.000 Precise Trust Region- 1.7 3.92e0 16.8 11.8 0.001 Adaptive L-BFGS- 1.0 3.51e0 209.8 79.3 0.003 Limited QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 Golden-Section L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS- 30.0 3.39e0 152.4 68.5 0.002 QQN-Bissection- 31.7 3.24e0 51.0 62.7 0.001  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN-Bissection- 33.3 3.26e0 71.7 107.2 0.002  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN-Bissection- 33.3 3.26e0 71.7 107.2 0.002  Trust Region- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.005		Conservative					
Weight Decay   Adam-Fast   0.0   3.61e0   80.9   79.9   0.002     GD			0.0	3.61e0	20.5	37.5	0.001
Adam-Fast 0.0 3.61e0 80.9 79.9 0.002 GD- 0.0 3.58e0 21.9 40.9 0.001 AdaptiveMomentum Adam- 0.0 3.58e0 195.6 1054.6 0.025 AMSGrad Ackley Adam- 0.0 3.58e0 194.6 193.6 0.005 WeightDecay Adam-Robust 0.0 3.58e0 76.2 75.2 0.002 GD-Momentum 0.0 3.74e0 14.1 24.1 0.000 Adam 0.0 3.57e0 57.1 111.1 0.002 GD-Momentum 0.0 3.76e0 552.0 531.0 0.012 GD 0.0 3.57e0 57.1 111.1 0.002 Trust Region- 0.0 3.60e0 42.5 28.9 0.000 Precise Trust Region- 0.0 4.68e0 8.9 6.6 0.000 Standard Trust Region- 1.7 3.92e0 16.8 11.8 0.000 Adaptive L-BFGS- 5.0 3.51e0 209.8 79.3 0.003 Limited QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 L-BFGS- 3 0.0 3.39e0 152.4 68.5 0.002 QQN- Bisection- 31.7 3.24e0 51.0 62.7 0.001 L-BFGS- 3 0.0 3.39e0 152.4 68.5 0.002 QQN- Bisection- 31.7 3.24e0 51.0 62.7 0.001 L-BFGS- 3 0.0 3.39e0 152.4 68.5 0.002 QQN- Bisection- 31.7 3.24e0 51.0 62.7 0.001 L-BFGS- 3 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 L-BTGS- 0.0 1.13e0 172.7 101.8 0.004			0.0	3.60e0	28.0	52.0	0.001
GD- 0.0 3.58e0 21.9 40.9 0.001 AdaptiveMomentum Adam- 0.0 3.57e0 1055.6 1054.6 0.025 Ackley Adam- 0.0 3.58e0 194.6 193.6 0.005 WeightDecay Adam-Robust 0.0 3.58e0 76.2 75.2 0.002 GD-Momentum 0.0 3.74e0 14.1 24.1 0.000 Adam 0.0 3.57e0 532.0 531.0 0.012 GD 0.0 3.57e0 532.0 531.0 0.012 GD 0.0 3.57e0 552.0 531.0 0.012 GD 0.0 3.57e0 552.0 531.0 0.002 Trust Region- 0.0 3.60e0 42.5 28.9 0.000 Precise Trust Region- 0.0 4.68e0 8.9 6.6 0.000 Standard Trust Region- 1.7 3.92e0 16.8 11.8 0.001 Conservative Trust Region- 1.7 3.92e0 16.8 11.8 0.000 Adaptive L-BFGS- 5.0 3.51e0 209.8 79.3 0.003 Limited QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 30.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS- 30.0 3.47e0 49.7 36.5 0.001 CubicQuadraticInterpolation L-BFGS- 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 CubicQuadraticInterpolation L-BFGS- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 CubicQuadraticInterlined L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 CubicQuadraticInterlined L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 CubicQuadraticInterlined L-BFGS- 0.0 1.13e0 172.7 101.8 0.004		WeightDecay					
Adam		Adam-Fast	0.0	3.61e0	80.9	79.9	0.002
Ackley Adam- 0.0 3.57e0 1055.6 1054.6 0.025		GD-	0.0	3.58e0	21.9	40.9	0.001
Ackley		AdaptiveMoment					
Ackley         Adam-Weight Decay Weight Decay         0.0         3.58e0         194.6         193.6         0.005           Adam-Robust         0.0         3.58e0         76.2         75.2         0.002           GD-Momentum         0.0         3.74e0         14.1         24.1         0.000           Adam         0.0         3.57e0         532.0         531.0         0.012           GD         0.0         3.57e0         57.1         111.1         0.002           Precise         Trust Region-         0.0         3.60e0         42.5         28.9         0.000           Standard         Trust Region-         0.0         4.68e0         8.9         6.6         0.000           Standard         Trust Region-         0.0         3.58e0         196.4         131.5         0.001           Conservative         Trust Region-         1.7         3.92e0         16.8         11.8         0.001           Adaptive         L.BFGS-         5.0         3.51e0         209.8         79.3         0.003           Limited         QQN-         6.7         3.52e0         65.0         62.1         0.002           StrongWolfe         QQN-         16.7         3.		Adam-	0.0	3.57e0	1055.6	1054.6	0.025
WeightDecay   Adam-Robust   0.0   3.58e0   76.2   75.2   0.002		AMSGrad					
Adam-Robust   0.0   3.58e0   76.2   75.2   0.002	Ackley	Adam-	0.0	3.58e0	194.6	193.6	0.005
GD-Momentum   0.0   3.74e0   14.1   24.1   0.000   Adam   0.0   3.57e0   532.0   531.0   0.012   GD   0.0   3.57e0   57.1   111.1   0.002   Trust   Region   0.0   3.60e0   42.5   28.9   0.000   Precise   Trust   Region   0.0   4.68e0   8.9   6.6   0.000   Standard   Trust   Region   0.0   3.58e0   196.4   131.5   0.001   Conservative   Trust   Region   1.7   3.92e0   16.8   11.8   0.000   Adaptive   L-BFGS   5.0   3.51e0   209.8   79.3   0.003   Limited   QQN   6.7   3.52e0   65.0   62.1   0.002   StrongWolfe   QQN   13.3   3.42e0   172.7   38.4   0.003   GoldenSection   L-BFGS   15.0   3.68e0   2118.3   639.2   0.014   Aggressive   QQN   16.7   3.53e0   391.7   461.3   0.012   CubicQuadraticInterpolation   L-BFGS   20.0   3.47e0   49.7   36.5   0.001   MoreThuente   L-BFGS   30.0   3.39e0   152.4   68.5   0.002   QQN-Bisection   31.7   3.24e0   51.0   62.7   0.001   2   QQN-Bisection   31.7   3.24e0   51.0   62.7   0.001   3   QQN-Bisection   31.7   3.24e0   51.0   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00		WeightDecay					
Adam		Adam-Robust	0.0	3.58e0	76.2	75.2	0.002
GD		GD-Momentum	0.0	3.74e0	14.1	24.1	0.000
Trust Region- Precise Trust Region- 10.0		Adam	0.0	3.57e0	532.0	531.0	0.012
Precise   Trust   Region-   0.0   4.68e0   8.9   6.6   0.000   Standard   Trust   Region-   0.0   3.58e0   196.4   131.5   0.001   Conservative   Trust   Region-   1.7   3.92e0   16.8   11.8   0.000   Adaptive   L-BFGS-   5.0   3.51e0   209.8   79.3   0.003   Limited   QQN-   6.7   3.52e0   65.0   62.1   0.002   StrongWolfe   QQN-   13.3   3.42e0   172.7   38.4   0.003   GoldenSection   L-BFGS-   15.0   3.68e0   2118.3   639.2   0.014   Aggressive   QQN-   16.7   3.53e0   391.7   461.3   0.012   CubicQuadraticInterpolation   L-BFGS-   20.0   3.47e0   49.7   36.5   0.001   MoreThuente   L-BFGS-   30.0   3.39e0   152.4   68.5   0.002   QQN-Bisection-   31.7   3.24e0   51.0   62.7   0.001   2   QQN-Bisection-   33.3   3.26e0   71.7   107.2   0.002   QQN-Bisection-   33.3   3.26e0   71.7   107.2   0.002   1   Trust   Region-   0.0   1.46e0   19.8   14.2   0.000   Standard   QQN-   0.0   0.16e0   19.8   14.2   0.000   GoldenSection   L-BFGS-   0.0   1.13e0   172.7   101.8   0.004   Limited   Adam   0.0   1.13e0   2502.0   2502.0   2502.0   0.053   Trust   Region-   0.0   2.58e0   7.0   5.4   0.000		$\operatorname{GD}$	0.0	3.57e0	57.1	111.1	0.002
Trust Region- 0.0 4.68e0 8.9 6.6 0.000 Standard  Trust Region- 0.0 3.58e0 196.4 131.5 0.001 Conservative  Trust Region- 1.7 3.92e0 16.8 11.8 0.000 Adaptive  L-BFGS- 5.0 3.51e0 209.8 79.3 0.003 Limited  QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe  QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection  L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive  QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation  L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente  L-BFGS- 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1 Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.000 GoldenSection  L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited  Adam 0.0 1.13e0 2502.0 2502.0 2502.0 0.053 Trust Region- 0.0 1.13e0 2502.0 2502.0 0.053		Trust Region-	0.0	3.60e0	42.5	28.9	0.000
Standard   Trust Region   0.0   3.58e0   196.4   131.5   0.001   Conservative   Trust Region   1.7   3.92e0   16.8   11.8   0.000   Adaptive   L-BFGS   5.0   3.51e0   209.8   79.3   0.003   Limited   QQN   6.7   3.52e0   65.0   62.1   0.002   StrongWolfe   QQN   13.3   3.42e0   172.7   38.4   0.003   GoldenSection   L-BFGS   15.0   3.68e0   2118.3   639.2   0.014   Aggressive   QQN   16.7   3.53e0   391.7   461.3   0.012   CubicQuadraticInterpolation   L-BFGS   20.0   3.47e0   49.7   36.5   0.001   MoreThuente   L-BFGS   30.0   3.39e0   152.4   68.5   0.002   QQN-Bisection   31.7   3.24e0   51.0   62.7   0.001   2   QQN-Bisection   33.3   3.26e0   71.7   107.2   0.002   1   Trust Region   0.0   1.46e0   19.8   14.2   0.000   Standard   QQN   0.0   inf   0.0   0.0   0.000   GoldenSection   L-BFGS   0.0   1.13e0   172.7   101.8   0.004   Limited   Adam   0.0   1.13e0   2502.0   2502.0   0.053   Trust Region   0.0   0.58e0   7.0   5.4   0.000		Precise					
Trust Region- Conservative         0.0         3.58e0         196.4         131.5         0.001 Conservative           Trust Region- 1.7         3.92e0         16.8         11.8         0.000 Adaptive           L-BFGS- 5.0         3.51e0         209.8         79.3         0.003 Limited           QQN- 6.7         3.52e0         65.0         62.1         0.002 StrongWolfe           QQN- 13.3         3.42e0         172.7         38.4         0.003 GoldenSection           L-BFGS- 15.0         3.68e0         2118.3         639.2         0.014 Aggressive           QQN- 16.7         3.53e0         391.7         461.3         0.012 CubicQuadraticInterpolation           L-BFGS- 20.0         3.47e0         49.7         36.5         0.001 MoreThuente           L-BFGS- 30.0         3.39e0         152.4         68.5         0.002 CQN-Bisection-31.7         3.24e0         51.0         62.7         0.001 CQN-DICQUARD CONTRACT CONTRAC		0	0.0	4.68e0	8.9	6.6	0.000
Trust Region- 1.7 3.92e0 16.8 11.8 0.000 Adaptive L-BFGS- 5.0 3.51e0 209.8 79.3 0.003 Limited QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000			0.0	3.58e0	196.4	131.5	0.001
Trust Region- 1.7 3.92e0 16.8 11.8 0.000 Adaptive L-BFGS- 5.0 3.51e0 209.8 79.3 0.003 Limited QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000		0					
Adaptive L-BFGS- 5.0 3.51e0 209.8 79.3 0.003 Limited QQN- 6.7 3.52e0 65.0 62.1 0.002 StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 1.13e0 7.0 5.4 0.000			1.7	3.92e0	16.8	11.8	0.000
L-BFGS-   5.0   3.51e0   209.8   79.3   0.003   1.51e1   209.8   209.8   79.3   0.003   1.51e1   209.8   209		_					
Limited   QQN-   6.7   3.52e0   65.0   62.1   0.002   StrongWolfe   QQN-   13.3   3.42e0   172.7   38.4   0.003   GoldenSection   L-BFGS-   15.0   3.68e0   2118.3   639.2   0.014   Aggressive   QQN-   16.7   3.53e0   391.7   461.3   0.012   CubicQuadraticInterpolation   L-BFGS-   20.0   3.47e0   49.7   36.5   0.001   MoreThuente   L-BFGS   30.0   3.39e0   152.4   68.5   0.002   QQN-Bisection-   31.7   3.24e0   51.0   62.7   0.001   2   QQN-Bisection-   33.3   3.26e0   71.7   107.2   0.002   1   1   1   1   1   1   1   1   1		•	5.0	3.51e0	209.8	79.3	0.003
QQN-       6.7       3.52e0       65.0       62.1       0.002         StrongWolfe       QQN-       13.3       3.42e0       172.7       38.4       0.003         GoldenSection       L-BFGS-       15.0       3.68e0       2118.3       639.2       0.014         Aggressive       QQN-       16.7       3.53e0       391.7       461.3       0.012         CubicQuadraticInterpolation       L-BFGS-       20.0       3.47e0       49.7       36.5       0.001         MoreThuente       L-BFGS       30.0       3.39e0       152.4       68.5       0.002         QQN-Bisection-       31.7       3.24e0       51.0       62.7       0.001         2       QQN-Bisection-       33.3       3.26e0       71.7       107.2       0.002         1       Trust Region-       0.0       1.46e0       19.8       14.2       0.000         Standard       QQN-       0.0       inf       0.0       0.0       0.000         GoldenSection       L-BFGS-       0.0       1.13e0       172.7       101.8       0.004         Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust							
StrongWolfe QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 1.58e0 7.0 5.4 0.000			6.7	3.52e0	65.0	62.1	0.002
QQN- 13.3 3.42e0 172.7 38.4 0.003 GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 1.58e0 7.0 5.4 0.000		• •					
GoldenSection L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000		0	13.3	3.42e0	172.7	38.4	0.003
L-BFGS- 15.0 3.68e0 2118.3 639.2 0.014 Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000		• •					
Aggressive QQN- 16.7 3.53e0 391.7 461.3 0.012 CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000			15.0	3.68e0	2118.3	639.2	0.014
QQN-       16.7       3.53e0       391.7       461.3       0.012         Cubic Quadratic Interpolation         L-BFGS-       20.0       3.47e0       49.7       36.5       0.001         More Thuente       1.2       49.7       36.5       0.001         L-BFGS       30.0       3.39e0       152.4       68.5       0.002         QQN-Bisection-       31.7       3.24e0       51.0       62.7       0.001         2       QQN-Bisection-       33.3       3.26e0       71.7       107.2       0.002         Trust Region-       0.0       1.46e0       19.8       14.2       0.000         Standard         QQN-       0.0       inf       0.0       0.0       0.000         GoldenSection       1.13e0       172.7       101.8       0.004         Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000							
CubicQuadraticInterpolation L-BFGS- 20.0 3.47e0 49.7 36.5 0.001 MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000			16.7	3.53e0	391.7	461.3	0.012
L-BFGS- 20.0 3.47e0 49.7 36.5 0.001  MoreThuente  L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000		• •					
MoreThuente L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000		•	•	3.47e0	49.7	36.5	0.001
L-BFGS 30.0 3.39e0 152.4 68.5 0.002 QQN-Bisection- 31.7 3.24e0 51.0 62.7 0.001 2 QQN-Bisection- 33.3 3.26e0 71.7 107.2 0.002 1  Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.0 0.00 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000							
QQN-Bisection-       31.7       3.24e0       51.0       62.7       0.001         QQN-Bisection-       33.3       3.26e0       71.7       107.2       0.002         Trust Region-       0.0       1.46e0       19.8       14.2       0.000         Standard         QQN-       0.0       inf       0.0       0.0       0.000         GoldenSection       L-BFGS-       0.0       1.13e0       172.7       101.8       0.004         Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000			30.0	3.39e0	152.4	68.5	0.002
QQN-Bisection- 1 33.3 3.26e0 71.7 107.2 0.002 1 Trust Region- Standard QQN- QQN- GoldenSection L-BFGS- Limited Adam Adam O.0 1.13e0 1.13e0 2.502.0 2.502.0 2.502.0 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000							
QQN-Bisection-1       33.3       3.26e0       71.7       107.2       0.002         Trust Region-Standard       0.0       1.46e0       19.8       14.2       0.000         QQN-QN-QQN-QQN-GoldenSection       0.0       inf       0.0       0.0       0.000         L-BFGS-Limited       0.0       1.13e0       172.7       101.8       0.004         Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000		• •	01.,	0. <b>=</b> 100	01.0	0	0.001
Trust Region- 0.0 1.46e0 19.8 14.2 0.000 Standard QQN- 0.0 inf 0.0 0.0 0.000 GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000			33.3	3.26e0	71.7	107.2	0.002
Standard         QQN-       0.0       inf       0.0       0.0       0.000         GoldenSection       L-BFGS-       0.0       1.13e0       172.7       101.8       0.004         Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000			00.0	0.200	, _ , ,		3.332
Standard         QQN-       0.0       inf       0.0       0.0       0.000         GoldenSection       L-BFGS-       0.0       1.13e0       172.7       101.8       0.004         Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000		Trust Region-	0.0	1.46e0	19.8	14.2	0.000
QQN-       0.0       inf       0.0       0.0       0.000         GoldenSection       L-BFGS-       0.0       1.13e0       172.7       101.8       0.004         Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000		_					
GoldenSection L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000			0.0	$\inf$	0.0	0.0	0.000
L-BFGS- 0.0 1.13e0 172.7 101.8 0.004 Limited Adam 0.0 1.13e0 2502.0 2502.0 0.053 Trust Region- 0.0 2.58e0 7.0 5.4 0.000		• •					
Limited       Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust Region-       0.0       2.58e0       7.0       5.4       0.000			0.0	1.13e0	172.7	101.8	0.004
Adam       0.0       1.13e0       2502.0       2502.0       0.053         Trust       Region-       0.0       2.58e0       7.0       5.4       0.000			0.0	000	-, -·,	101.0	0.001
Trust Region- 0.0 2.58e0 7.0 5.4 0.000			0.0	1.13e0	2502.0	2502.0	0.053
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Aggressive 1		0	0.0	2.3860	1.0	0.4	0.000