

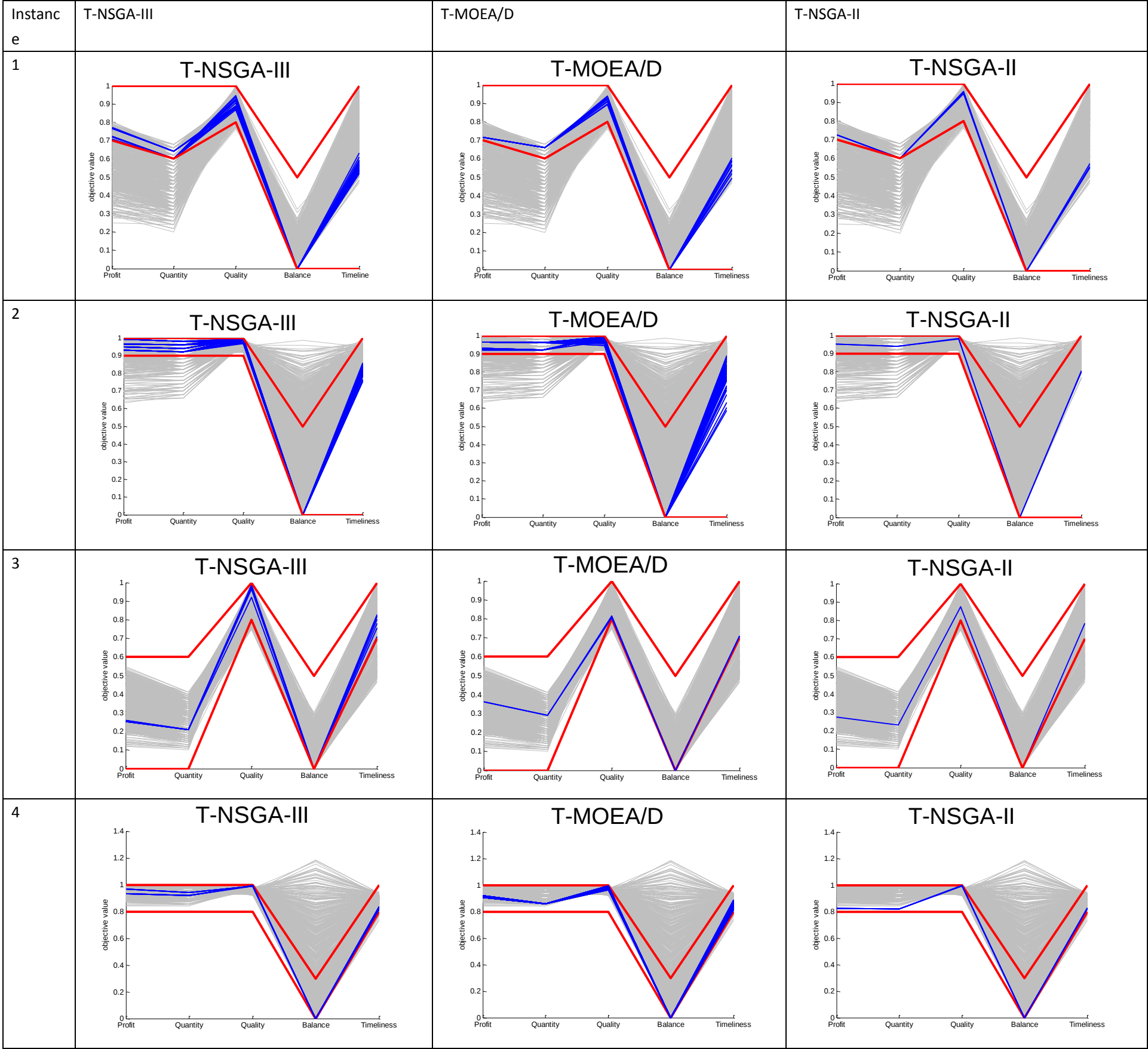
If you have interest, Please contact Longmei Li (vivianlee527@163.com) for the source code.
The following experiments use integer coding, start time initializes at 0.5 and ordered by time.

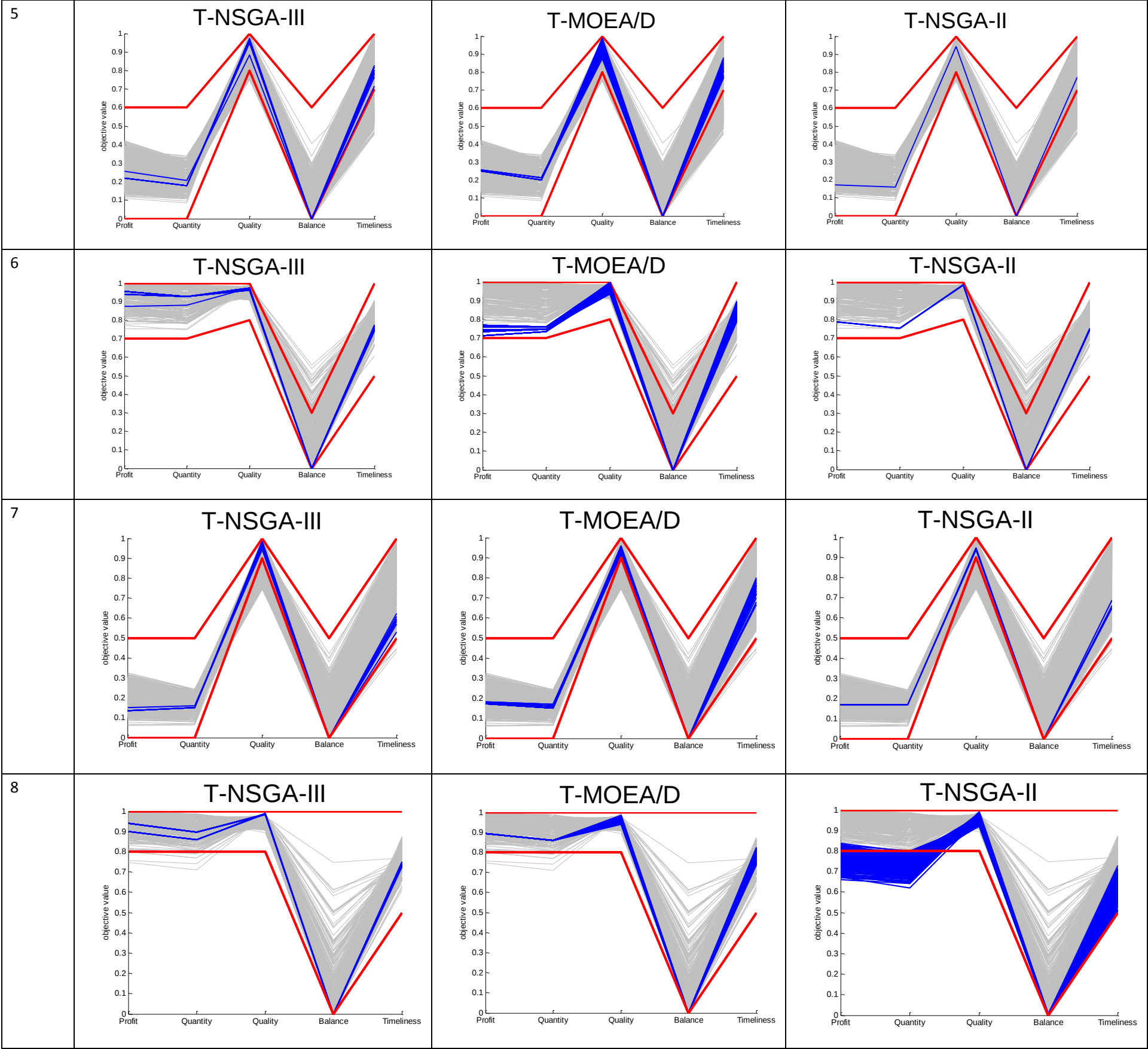
A-priori

Part 1: comparison among T-MOEA/D and T-NSGA-III
PS=200. NOE=150000

Problem instance	Task Count	AccessWindow Count	Distribution	Target region
1	50	251	C	$\{(0.7,0.6,0.8,0,0),(1,1,1,0.5,1)\}$
2	50	266	R	$\{(0.9,0.9,0.9,0,0),(1,1,1,0.5,1)\}$
3	100	512	C	$\{(0.0,0.0,0.8,0,0.7),(0.6,0.6,1,0.5,1)\}$
4	100	576	R	$\{(0.8,0.8,0.8,0,0.8),(1,1,1,0.3,1)\}$
5	150	762	C	$\{(0.0,0.0,0.8,0,0.7),(0.6,0.6,1,0.6,1)\}$
6	150	820	R	$\{(0.7,0.7,0.8,0,0.5),(1,1,1,0.3,1)\}$
7	200	1009	C	$\{(0.0,0.0,0.9,0,0.5),(0.5,0.5,1,0.5,1)\}$
8	200	1128	R	$\{(0.8,0.8,0.8,0,0.5),(1,1,1,1,1)\}$

Graphic Results:





HV indicator

Instance	T-NSGA-III	T-MOEA/D	T-NSGA-II
1	1.350e-3(9.47e-4)*	1.232e-3(1.25e-3)*	1.194e-4(4.51e-4)
2	0.12806(0.0358)	0.06016(0.0565)	9.54e-3(0.0280)
3	0.01585(6.77e-3)*	0.01326(6.44e-3)*	5.724e-3(3.67e-3)
4	0.07933(0.0418)*	0.04527(0.0404)*	2.845e-3(4.01e-3)
5	8.611e-3(2.02e-3)*	7.814e-3(2.47e-3)*	2.929e-3(1.31e-3)
6	0.11309(0.0581)	0.05068(0.03541)	7.620e-3(0.0112)
7	8.141e-3(4.55e-3)*	0.01239(3.93e-3)*	4.103e-3(1.68e-3)
8	0.01777(0.0108)*	0.01606(7.38e-3)*	0.00000(4.46e-5)

CPU Runtime

Instance	T-NSGA-III	T-MOEA/D	T-NSGA-II
1	7.86	5.93	31.33
2	9.20	7.20	35.87
3	9.47	7.20	45.53
4	18.20	16.67	35.47
5	18.80	14.87	67.93
6	45.60	41.87	70.20
7	22.13	17.53	90.40
8	57.67	50.80	49.93

Instance1

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Total satellites: 2, Total targets: 50, total profit: 285
T-NSGA-II: 470.0 seconds

T-MOEA/D: 89.0 seconds

T-NSGA-III: 118.0 seconds

T-MOEA/D:
Hypervolume:
Min: 3.117035154144616E-4
Median: 0.0012323505089894416
Max: 0.00473942742718322
Standard Deviation: 0.001252556992896162
Count: 15
Indifferent: [T-NSGA-III]
Values: [0.0010472992387559066, 0.0010016995340053653, 0.003523714963432567, 0.00473942742718322, 0.0011702843395523133, 0.00380620217599386, 0.0012323505089894416, 0.003065298152687734, 8.827575779508272E-4, 0.001496175934858228, 0.0012190481078394814, 0.001313489580150523, 3.117035154144616E-4, 0.0011402701101408336, 0.00237692711480268]
T-NSGA-III:
Hypervolume:
Min: 0.0
Median: 0.001349911608048297
Max: 0.003320566698583673
Standard Deviation: 9.472837050071881E-4
Count: 15
Indifferent: [T-MOEA/D]
Values: [0.0015488237394257125, 8.452036891773096E-4, 0.0, 8.479850765528303E-4, 0.003320566698583673, 0.0027679953220804358, 0.0, 1.3533674873297393E-4, 0.0026370911104467705, 0.0013219620878053547, 0.0016451738254992666, 0.0017461436485996322, 0.001349911608048297, 0.001461846870265821, 0.001243393282918088]
T-NSGA-II:
Hypervolume:
Min: 0.0

Median: 1.1944741942235432E-4
Max: 0.001710492408931788
Standard Deviation: 4.512278740001622E-4
Count: 15
Indifferent: []
Values: [3.229954531752206E-4, 0.0, 0.0, 1.1944741942235432E-4, 0.0, 7.16315119657653E-4, 1.6629274490269117E-4, 0.001710492408931788, 2.0348324141808625E-4, 7.465066771972273E-4, 0.0, 0.0, 0.0, 0.0, 2.1231371365618772E-4]
Finish

Instance 2

T-NSGA-II: 538.0 seconds

T-MOEA/D: 108.0 seconds

T-NSGA-III: 138.0 seconds

T-MOEA/D:

PopulationSizeInROI:

Min: 16.0

Median: 35.0

Max: 45.0

Standard Deviation: 8.185081279715893

Count: 15

Indifferent: []

Values: [38.0, 26.0, 35.0, 45.0, 16.0, 41.0, 34.0, 38.0, 30.0, 35.0, 31.0, 17.0, 28.0, 42.0, 38.0]

Hypervolume:

Min: 0.0

Median: 0.06015792159303737

Max: 0.1652302750255505

Standard Deviation: 0.05650884655161513

Count: 15

Indifferent: []

Values: [0.11349478655726113, 0.1596775249501254, 0.019637925697836466, 0.1652302750255505, 0.020010470166213417, 0.05438345729272846, 0.06378228005998983, 0.16236088979310573, 0.05447956411061043, 0.0, 0.06015792159303737, 0.026012939309015035, 0.10352600120260144, 0.0, 0.11660267534628146]

T-NSGA-III:

PopulationSizeInROI:

Min: 14.0

Median: 24.0

Max: 37.0

Standard Deviation: 6.270211763214665

Count: 15

Indifferent: []

Values: [28.0, 20.0, 37.0, 28.0, 21.0, 24.0, 19.0, 19.0, 30.0, 32.0, 17.0, 22.0, 24.0, 14.0, 32.0]

Hypervolume:

Min: 0.06621129993316871

Median: 0.12806008099208296

Max: 0.18159377359209505

Standard Deviation: 0.03582366717678066

Count: 15

Indifferent: []

Values: [0.18159377359209505, 0.11243065790676826, 0.12773944517412086, 0.08562015108976294, 0.09354348608155919, 0.17229292514751435, 0.16926165081267783, 0.10968447023751227, 0.14194095473278553, 0.17244451286013052, 0.11240595466711573, 0.12806008099208296, 0.17457214327897153, 0.06621129993316871, 0.16430472731015336]

T-NSGA-II:

PopulationSizeInROI:

Min: 1.0

Median: 2.0

Max: 16.0
Standard Deviation: 3.4871191548325386
Count: 15
Indifferent: []
Values: [3.0, 2.0, 2.0, 3.0, 2.0, 3.0, 16.0, 4.0, 2.0, 1.0, 2.0, 2.0, 2.0, 2.0, 2.0]
Hypervolume:
Min: 0.0
Median: 0.009540718019332008
Max: 0.08731194049196189
Standard Deviation: 0.028019052064218734
Count: 15
Indifferent: []
Values: [0.0, 0.060092089972609494, 0.0, 0.05608899154702062, 0.0, 0.08731194049196189, 0.048229901234780374, 0.0, 0.02601195603293729, 0.0, 0.0, 0.009540718019332008, 0.048344526478502604, 0.0, 0.02063277597935193]
Finish

Instance 3

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Total satellites:2, Total targets: 100, total profit: 572
T-NSGA-II: 683.0 seconds

T-MOEA/D: 108.0 seconds

T-NSGA-III: 142.0 seconds

T-MOEA/D:
Hypervolume:
Min: 0.0040255673393194595
Median: 0.013257282591134841
Max: 0.0247272314804826
Standard Deviation: 0.006439239423311986
Count: 15
Indifferent: [T-NSGA-III]
Values: [0.013257282591134841, 0.007796224892524024, 0.024013051185246003, 0.0247272314804826, 0.008161176387782416, 0.016627952899422767, 0.011094715782696636, 0.014653817193371811, 0.018758502473411383, 0.01563647110922364, 0.01205330659571175, 0.023756799707351624, 0.009030432799961434, 0.0056776665922432, 0.0040255673393194595]
T-NSGA-III:
Hypervolume:
Min: 0.005505016595988191
Median: 0.01585393845141866
Max: 0.029544503194227804
Standard Deviation: 0.006774518433146959
Count: 15
Indifferent: [T-MOEA/D]
Values: [0.027759652547583967, 0.017141642951687956, 0.01865625853669771, 0.007891596766188945, 0.013944553541381929, 0.029544503194227804, 0.017487569295061223, 0.018368107434213906, 0.01585393845141866, 0.013976516178860731, 0.005505016595988191, 0.010237378426280573, 0.006687306417049667, 0.008899175860939126, 0.017730858898986755]
T-NSGA-II:
Hypervolume:
Min: 3.2489421432311703E-4
Median: 0.005723879252016643
Max: 0.011682739327738771
Standard Deviation: 0.0036724679638319925
Count: 15
Indifferent: []
Values: [0.007696681993206922, 0.005723879252016643, 3.2489421432311703E-4, 0.0029274160334926925, 6.478076132950747E-4, 0.001962951302302651, 0.0040583759955527526, 0.010309755192318278, 0.004698562654339692, 0.011682739327738771, 0.005740661114140729, 0.010161515147809212, 0.0028143595212297627, 0.007646296605605254, 0.011155906758028727]
Finish

Instance 4

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Total satellites:2, Total targets: 100, total profit: 563

T-NSGA-II: 532.0 seconds

T-MOEA/D: 250.0 seconds

T-NSGA-III: 273.0 seconds

T-MOEA/D:

Hypervolume:

Min: 0.001369176784604711

Median: 0.045268647389763196

Max: 0.13229240182903218

Standard Deviation: 0.04044728196658642

Count: 15

Indifferent: [T-NSGA-III]

Values: [0.0193237607362621, 0.0371926188125325, 0.09486879898417717, 0.13229240182903218, 0.001369176784604711, 0.09420821988451226, 0.10680074025345321, 0.04060167384843086, 0.03133313667699911, 0.0589470115965516, 0.009322769941544753, 0.10158194924475282, 0.045268647389763196, 0.013681783479615024, 0.09586264789751019]

T-NSGA-III:

Hypervolume:

Min: 0.0

Median: 0.07932759498673457

Max: 0.1316320630505715

Standard Deviation: 0.04176204612905267

Count: 15

Indifferent: [T-MOEA/D]

Values: [0.07925985436234177, 0.1316320630505715, 0.06944598276296159, 0.07932759498673457, 0.10973238269399846, 0.12374735566542745, 0.004846024164441798, 0.07971466899184185, 0.0, 0.03667201079113534, 0.10873708254370024, 0.10363441933200129, 0.0855218115451884, 0.003741850512422939, 0.05787601736538851]

T-NSGA-II:

Hypervolume:

Min: 0.0

Median: 0.0028454828787341747

Max: 0.012999250767798284

Standard Deviation: 0.004011154380269046

Count: 15

Indifferent: []

Values: [0.012999250767798284, 0.0, 0.0, 0.0, 0.007756387452562554, 0.0027784972273804196, 0.0028454828787341747, 0.0017129582276602922, 0.0064934812792680425, 0.00492229842154098, 0.0, 0.008363127022252325, 0.009633841886031605, 0.00484281786415069, 0.0]

Finish

Instance 5

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Total satellites:2, Total targets: 150, total profit: 846

T-NSGA-II: 1019.0 seconds

T-MOEA/D: 223.0 seconds

T-NSGA-III: 282.0 seconds

T-MOEA/D:

Hypervolume:

Min: 0.004335715711349132

Median: 0.007813634092851782

Max: 0.012318805764405773

Standard Deviation: 0.0024735486004372315

Count: 15

Indifferent: [T-NSGA-III]

Values: [0.00497268254404218, 0.007813634092851782, 0.005959753781230391,

0.006968203624760174, 0.007036641244485111, 0.010427576711687245, 0.005844666910557219, 0.012318805764405773, 0.011804916670607473, 0.009789629126164323, 0.009137082620417857, 0.010628012855579986, 0.0051844139878643985, 0.004335715711349132, 0.00804422431162138]

T-NSGA-III:

Hypervolume:

Min: 0.0028382369710398423

Median: 0.008610619673817462

Max: 0.011945237615688333

Standard Deviation: 0.0020181234965964434

Count: 15

Indifferent: [T-MOEA/D]

Values: [0.009435828643269268, 0.011217510800464344, 0.007872485342382203, 0.008610619673817462, 0.009941785334417776, 0.008738453940546446, 0.008170329407030314, 0.011945237615688333, 0.008792944518520845, 0.00692294568503854, 0.009332366508719672, 0.0028382369710398423, 0.0077711612896822855, 0.008516128194446467, 0.006927270551034977]

T-NSGA-II:

Hypervolume:

Min: 9.07608184210639E-4

Median: 0.0029287018803412297

Max: 0.005312236256799888

Standard Deviation: 0.001311083464400447

Count: 15

Indifferent: []

Values: [0.005300465074188632, 0.00450908507373597, 0.0038352641939565207, 0.0013872440294623524, 0.002356842662644458, 0.0022378826128834064, 9.07608184210639E-4, 0.0030440956739962283, 0.0018776152624601107, 0.0018654685134070442, 0.002706954989394904, 0.004096056366582062, 0.0036517648443251506, 0.005312236256799888, 0.0029287018803412297]

Finish

Instance 6

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Total satellites: 2, Total targets: 150, total profit: 770

T-NSGA-II: 1053.0 seconds

T-MOEA/D: 628.0 seconds

T-NSGA-III: 684.0 seconds

T-MOEA/D:

Hypervolume:

Min: 5.861515348303696E-4

Median: 0.05068159504932735

Max: 0.12528545941505884

Standard Deviation: 0.03538567757206138

Count: 15

Indifferent: []

Values: [0.05849839137044196, 0.044835705166254076, 0.12528545941505884, 0.07043540875513939, 0.05068159504932735, 0.012280766717512534, 0.025711520807378867, 5.861515348303696E-4, 0.06267269701479755, 0.09477895818279737, 0.03950525115170254, 0.05944881570861796, 0.04837533244290253, 0.11113489083017912, 0.0025394692859564386]

T-NSGA-III:

Hypervolume:

Min: 0.024051049381166683

Median: 0.1130865220208437

Max: 0.19859325683166873

Standard Deviation: 0.05787414477842486

Count: 15

Indifferent: []

Values: [0.17402223716956386, 0.04677592092397654, 0.08901004092673982, 0.14997554754253442, 0.1878014791144661, 0.09125216965616646, 0.1657026317216238, 0.024051049381166683, 0.11620511607326028, 0.19859325683166873, 0.04504284268909342, 0.1756238171663456, 0.025918446762251777, 0.1130865220208437, 0.11254899175974896]

T-NSGA-II:
Hypervolume:
Min: 0.0027823857888262687
Median: 0.0076198295798486524
Max: 0.034862237934668694
Standard Deviation: 0.010565460189020333
Count: 15
Indifferent: []
Values: [0.02056531177354856, 0.005060624409225349, 0.023260371957698468,
0.003691798805651134, 0.0076198295798486524, 0.0189744726487581, 0.007593215424289278,
0.005546454828927786, 0.006791914722003792, 0.034862237934668694, 0.00989726047966116,
0.0326538500090775, 0.0027823857888262687, 0.025066645128886893, 0.004990129933481174]
Finish

Instance 7

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Total satellites:2, Total targets: 200, total profit: 1100
T-NSGA-II: 1356.0 seconds

T-MOEA/D: 263.0 seconds

T-NSGA-III: 332.0 seconds

T-MOEA/D:
Hypervolume:
Min: 0.00504853949321186
Median: 0.012389002144432565
Max: 0.018873501264476043
Standard Deviation: 0.003933902352656755
Count: 15
Indifferent: [T-NSGA-III]
Values: [0.010190435259261037, 0.012614416885298988, 0.007409824704729932,
0.015080545100014636, 0.005692023987361726, 0.009381485973515609, 0.016178195372912717,
0.018873501264476043, 0.014187261195626452, 0.011426361608536995, 0.013414851634701633,
0.012389002144432565, 0.015720338067946177, 0.007684827638594574, 0.00504853949321186]
T-NSGA-III:
Hypervolume:
Min: 0.0030166851490716715
Median: 0.008140737817679239
Max: 0.018861385055050313
Standard Deviation: 0.004546280400175783
Count: 15
Indifferent: [T-MOEA/D]
Values: [0.018861385055050313, 0.009514376546208394, 0.011768256440484563,
0.004667809162415688, 0.004142431694735471, 0.007172336846528266, 0.006700158889565997,
0.012897008126914388, 0.008147234241342474, 0.005276352320368276, 0.008140737817679239,
0.004710495503990495, 0.017292915029874262, 0.009936833140451852, 0.0030166851490716715]
T-NSGA-II:
Hypervolume:
Min: 0.0011684373343254356
Median: 0.004103105739814347
Max: 0.007134109930818311
Standard Deviation: 0.0016751436484315528
Count: 15
Indifferent: []
Values: [0.0017087330863421704, 0.007134109930818311, 0.003269653961971773,
0.004103105739814347, 0.004894881334785238, 0.004874890038158618, 0.003206432364466356,
0.005175740022004001, 0.0023535073679711947, 0.005101054194641429, 0.001642380493380875,
0.0011684373343254356, 0.0029158970463222253, 0.006129732777157543, 0.004110320865977606]
Finish

Instance 8

Going to read .xlsx file!

Total satellites:2, Total targets: 200, total profit: 1069

Earlier: 0 Later: 0

T-NSGA-II: 749.0 seconds

T-MOEA/D: 762.0 seconds

T-NSGA-III: 865.0 seconds

T-MOEA/D:

Hypervolume:

Min: 0.003529684817213755

Median: 0.016061835034216477

Max: 0.02391515311826875

Standard Deviation: 0.007381671175502547

Count: 15

Indifferent: [T-NSGA-III]

Values: [0.014584840588037086, 0.016061835034216477, 0.019710221598396867, 0.0050275325443588405, 0.019948058909814367, 0.018633622482661896, 0.014490941168119775, 0.021679391966680794, 0.0037578987017572217, 0.023844785136243683, 0.005442946557951291, 0.02391515311826875, 0.005437518454157647, 0.003529684817213755, 0.01940995042375929]

T-NSGA-III:

Hypervolume:

Min: 0.010084028026508892

Median: 0.017774576458214206

Max: 0.05202936955944118

Standard Deviation: 0.010819024536625066

Count: 15

Indifferent: [T-MOEA/D]

Values: [0.05202936955944118, 0.011464203080773328, 0.017774576458214206, 0.022963598572555866, 0.01798537084691458, 0.010084028026508892, 0.015321139313622034, 0.026467497440647966, 0.012688486728171319, 0.021204518813599395, 0.035616693264632356, 0.012997187642621623, 0.012032833659222086, 0.012636996250675235, 0.023643663871738493]

T-NSGA-II:

Hypervolume:

Min: 0.0

Median: 0.0

Max: 1.7726936677340654E-4

Standard Deviation: 4.465836972116623E-5

Count: 15

Indifferent: []

Values: [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.7726936677340654E-4, 4.073833486587027E-5, 0.0, 0.0, 0.0]

Finish