|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SUMT Exterior Penalty | | | | | | |
| P | 1 | 2 | 3 | 4 | 5 | 6 |
| rp | 1 | 5 | 25 | 125 | 625 | 3125 |
| x0 | 0  0  0 | 1.276757470185778 14.282241785987278 -2.921714161272035 | 1.367313681237115 15.246682636432020 -2.644356099023211 | 1.506572258345380 16.838371086757036 -1.870468397277544 | 1.427422323989274 16.206891583266160 -0.802253513342547 | 1.303404309890892 14.966946773637224 0.119199519530206 |
| x\* | 1.276757470185778 14.282241785987278 -2.921714161272035 | 1.367313681237115 15.246682636432020 -2.644356099023211 | 1.506572258345380 16.838371086757036 -1.870468397277544 | 1.427422323989274 16.206891583266160 -0.802253513342547 | 1.303404309890892 14.966946773637224 0.119199519530206 | 1.245616259723662  14.388663156694799  0.561694734918270 |
| f(x\*) | 0.042441427986762 | 0.998187804502612 | 12.280830393731572 | 43.071049159105527 | 73.991792246489879 | 89.163085342838670 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.830272410557335 0.021405976148623 0.020160127570520 -0.785280223248410 -1.292171416127204 -0.415657167745593 -0.982605869505924 0.977636117936188 0.978980601697539 | -3.101941043711345 0.093850944989692 0.089048759745144 -0.905835329554002 -1.264435609902321 -0.471128780195358 -0.909661346819279 0.883850303053359 0.891179580663644 | -3.519716775036141 0.205257806676304 0.202740791911217 -1.104796385844629 -1.187046839727754 -0.625906320544491 -0.650857147798434 0.551102047169415 0.578456062297739 | -3.282266971967823 0.141937859191420 0.157635113090440 -1.025861447908270 -1.080225351334255 -0.839549297331491 -0.380495404354177 0.203494091312514 0.240161390982396 | -2.910212929672675 0.042723447912713 0.069067626688373  -0.870868346704653 -0.988080048046979 -1.023839903906041 -0.258569839380015 0.046732650631447 0.080283680647589 | -2.736848779170986  -0.003506992221070  0.027761654049628  -0.798582894586850  -0.943830526508173  -1.112338946983654  -0.222185320500602  -0.000047445070655  0.029396406892983 |
| No. or inter | 28 | 11 | 12 | 12 | 11 | 16 |
| exit-  flag | 1 | 1 | 1 | 1 | 1 | 1 |

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| SUMT Exterior Penalty (contd.) | | | | | | |
| P | 7 | 8 | 9 | 10 | 11 | 12 |
| rp | 15625 | 78125 | 390625 | 1953125 | 9765625 | 48828125 |
| x0 | 1.245616259723662 14.388663156694799 0.561694734918270 | 1.245616259723662 14.086828912272756 0.804461916983293 | 1.245616259723662 14.017801197861015 0.861374375049149 | 1.245616259723662 14.003578018675936 0.873170186707270 | 1.245616259723662 14.000715961212642 0.875546689456223 | 1.245616259723662  14.000141871099446  0.876023217302232 |
| x\* | 1.245616259723662 14.086828912272756 0.804461916983293 | 1.245616259723662 14.017801197861015 0.861374375049149 | 1.245616259723662 14.003578018675936 0.873170186707270 | 1.245616259723662 14.000715961212642 0.875546689456223 | 1.245616259723662  14.000141871099446  0.876023217302232 | 1.245616259723662  14.000028148183382  0.876117920663847 |
| f(x\*) | 97.508790704715992 | 99.465946895373833 | 99.871598089342427 | 99.953324735102143 | 99.969707396335551 | 99.972968423565220 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.736848779170986 -0.003506992221070 0.006202065162340 -0.760853614034094 -0.919553808301671 -1.160892383396658 -0.186597549678368 -0.045803150413527 0.006280001254589 | -2.736848779170986 -0.003506992221070 0.001271514132930 -0.752225149732627 -0.913862562495085 -1.172274875009830 -0.178474966383863 -0.056246471792176 0.001274791082862 | -2.736848779170986 -0.003506992221070 0.000255572762567 -0.750447252334492 -0.912682981329273 -1.174634037341454 -0.176801461345889 -0.058398121126714 0.000255738700570 | -2.736848779170986 -0.003506992221070 0.000051140086617 -0.750089495151580 -0.912445331054378 -1.175109337891244 -0.176464711465342 -0.058831085258847 0.000051180151172 | -2.736848779170986 -0.003506992221070 0.000010133649960  -0.750017733887431 -0.912397678269777 -1.175204643460446 -0.176397224231205 -0.058917854559879 0.000010241746917 | -2.736848779170986  -0.003506992221070  0.000002010584527  -0.750003518522923  -0.912388207933615  -1.175223584132769  -0.176383791316146  -0.058935125450669  0.000002055002479 |
| No. or inter | 11 | 9 | 6 | 10 | 7 | 6 |
| exit-  flag | 1 | 1 | 1 | 2 | 2 | 2 |

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| SUMT Exterior Penalty (contd.) | | | |
| P | 13 | 14 | 15 |
| rp | 244140625 | 1.220703125000000e+09 | 6.103515625000000e+09 |
| x0 | 1.245616259723662 14.000028148183382 0.876117920663847 | 1.245616259723662  14.000028468800194  0.876124113338654 | 1.245616259723662  13.999945578745367  0.876171322149313 |
| x\* | 1.245616259723662 14.000028468800194 0.876124113338654 | 1.245616259723662  13.999945578745367  0.876171322149313 | 1.245616259723662  13.999945706938167  0.876171575563591 |
| f(x\*) | 99.973292446196567 | 99.974543837296977 | 99.974558740329954 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.736848779170986  -0.003506992221070  0.000002033485728  -0.750003558600024  -0.912387588666135  -1.175224822667731  -0.176382456604978  -0.058936841507885  0.000000411554760 | -2.736848779170986  -0.003506992221070  -0.000003887232474  -0.749993197343171  -0.912382867785069  -1.175234264429863  -0.176377301906091  -0.058943468977884  0.000000073690674 | -2.736848779170986  -0.003506992221070  -0.000003878075845  -0.749993213367271  -0.912382842443641  -1.175234315112718  -0.176377240518085  -0.058943547905320  -0.000000010000120 |
| No. or inter | 2 | 3 | 1 |
| exit-  flag | 2 | 2 | 2 |

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| --- | --- | --- | --- | --- | --- | --- |
| SUMT Interior Penalty | | | | | | |
| P | 1 | 2 | 3 | 4 | 5 | 6 |
| rp | 1 | 0.200000000000000 | 0.040000000000000 | 0.008000000000000 | 0.001600000000000 | 3.200000000000000e-04 |
| x0 | 0.475058013560474 13.235315387885350 9.002524127606579 | 1.242051716019787 13.441551104374039 1.207219398288423 | 1.21034451759675 13.985678615012258 0.888073797550397 | 1.211402342892526 13.997185781437357 0.878480256183915 | 1.211402819590726 13.999439081569248 0.876607277522905 | 1.211402860049516 13.999886801893286  0.876235124597706 |
| x\* | 1.242051716019787 13.441551104374039 1.207219398288423 | 1.210344517596750  13.985678615012258  0.888073797550397 | 1.211402342892526 13.997185781437357 0.878480256183915 | 1.211402819590726 13.999439081569248 0.876607277522905 | 1.211402860049516 13.999886801893286 0.876235124597706 | 1.211402860049516 13.999886801893286  0.876235124597706 |
| f(x\*) | 1.085725163937203e+02 | 1.003845543265858e+02 | 1.000542248860218e+02 | 99.989798142317724 | 99.976995576143040 | 99.976995576143040 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.726155148059362  -0.006358627184170  -0.039889206830426  -0.680193888046755  -0.879278060171158  -1.241443879657685  -0.144147441149831  -0.100381861378789  -0.000548728235836 | -2.631033552790250  -0.031724385922600  -0.001022956070553  -0.748209826876532  -0.911192620244960  -1.177614759510079  -0.198060182424997  -0.031065479739289  -0.001027242204078 | -2.634207028677577  -0.030878125685979  -0.000201015611617  -0.749648222679670  -0.912151974381608  -1.175696051236783  -0.198680986541584  -0.030267303017964  -0.000201145923403 | -2.634208458772178 -0.030877744327419 -0.000040065602197 -0.749929885196156 -0.912339272247709 -1.175321455504581 -0.198938704839049 -0.029935950921224 -0.000040033071945 | -2.634208580148548  -0.030877711960387  -0.000008085579051  -0.749985850236661  -0.912376487540229  -1.175247024919541  -0.198989963161419  -0.029870047363890  -0.000007989634798 | -2.634208580148548  -0.030877711960387  -0.000008085579051  -0.749985850236661  -0.912376487540229  -1.175247024919541  -0.198989963161419  -0.029870047363890  -0.000007989634798 |
| No. or inter | 45 | 28 | 16 | 8 | 8 | 1 |
| exit-  flag | 0 | 5 | 1 | 2 | 2 | 2 |

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| --- | --- | --- | --- | --- | --- | --- |
| SUMT Linear Extended Interior Penalty | | | | | | |
| P | 1 | 2 | 3 | 4 | 5 | 6 |
| rp | 25.470164726578144 | 5.094032945315629 | 1.018806589063126 | 0.203761317812625 | 0.040752263562525 | 0.008150452712505 |
| x0 | 0.475058013560474 13.235315387885350 9.002524127606579 | 0.834131139714169 11.963258962706560 3.941625283990999 | 1.000652394693517 12.236051713002341 2.853394922611828 | 1.115365666879351 13.021288169458897 1.821546258167441 | 1.170535609943452 13.539475377703932  1.285556001618355 | 1.194427876487765 13.797706316840070 1.049162277714346 |
| x\* | 0.834131139714169 11.963258962706560 3.941625283990999 | 1.000652394693517 12.236051713002341 2.853394922611828 | 1.115365666879351 13.021288169458897 1.821546258167441 | 1.170535609943452 13.539475377703932 1.285556001618355 | 1.194427876487765 13.797706316840070  1.049162277714346 | 1.204528077550375 13.910737956511738 0.951239741438898 |
| f(x\*) | 2.341273493200837e+02 | 1.741522415104640e+02 | 1.338170291786038e+02 | 1.143006844268324e+02 | 1.059680557512164e+02 | 1.025646990423054e+02 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -1.502393419142507  -0.332695088228665  -0.145481502663817  -0.495407370338320  -0.605837471600900  -1.788325056798200  -0.155966408891668  -0.085186045710712  -0.307689036998923 | -2.001957184080550  -0.199478084245187  -0.125996306214119  -0.529506464125293  -0.714660507738817  -1.570678984522365  -0.126732905568099  -0.122771978555302  -0.153545536283816 | -2.346097000638052  -0.107707466496520  -0.069907987895793  -0.627661021182362  -0.817845374183256  -1.364309251633488  -0.146757879358040  -0.097025583682521  -0.076065102486295 | -2.511606829830356  -0.063571512045238  -0.032894615878291  -0.692434422212991  -0.871444399838164  -1.257111200323671  -0.172423083865238  -0.064027463601837  -0.034082425370034 | -2.583283629463295  -0.044457698809788  -0.014449548797138  -0.724713289605009  -0.895083772228565  -1.209832455542869  -0.186894804084932  -0.045420966176516  -0.014666412977479 | -2.613584232651124  -0.036377537959700  -0.006375860249162  -0.738842244563967  -0.904876025856110  -1.190247948287779  -0.193294151858642  -0.037193233324603  -0.006417151777776 |
| No. or inter | 30 | 21 | 15 | 12 | 11 | 12 |
| exit-  flag | 1 | 1 | 1 | 2 | 2 | 2 |

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| SUMT Linear Extended Interior Penalty (contd.) | | | | | | |
| P | 7 | 8 | 9 | 10 | 11 | 12 |
| rp | 0.001630090542501 | 3.260181085002002e-04 | 6.520362170004005e-05 | 1.304072434000801e-05 | 2.608144868001602e-06 | 5.216289736003204e-07 |
| x0 | 1.204528077550375 13.910737956511738 0.951239741438898 | 1.208901119373016 13.960166023280568  0.909416823572248 | 1.210840470509089 13.982165326219759  0.890992681080089 | 1.210847079236560 13.992015030592004  0.882781309378108 | 1.210847950693696 13.996426312711483  0.879111128648261 | 1.210848048770953 13.998400279770372  0.877469908221259 |
| x\* | 1.208901119373016 13.960166023280568 0.909416823572248 | 1.210840470509089 13.982165326219759  0.890992681080089 | 1.210847079236560 13.992015030592004  0.882781309378108 | 1.210847950693696 13.996426312711483  0.879111128648261 | 1.210848048770953 13.998400279770372  0.877469908221259 | 1.210848059661707 13.999285769555806  0.876734896921222 |
| f(x\*) | 1.011197365889512e+02 | 1.004848299247179e+02 | 1.002021856974592e+02 | 1.000759162584386e+02 | 1.000194578080266e+02 | 99.994191487556009 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.626703358119049  -0.032879104501587  -0.002845284051388  -0.745020752910071  -0.909058317642775  -1.181883364714450  -0.196088822665686  -0.033600085144118  -0.002853403964909 | -2.632521411527267  -0.031327623592729  -0.001273905270017  -0.747770665777470  -0.910900731891991  -1.178198536216018  -0.197330979336961  -0.032003026566764  -0.001275497992858 | -2.632541237709678  -0.031322336610752  -0.000570354957714  -0.749001878824000  -0.911721869062189  -1.176556261875622  -0.198456275204993  -0.030556217593580  -0.000570663546899 | -2.632543852081089  -0.031321639445043  -0.000255263377751  -0.749553289088935  -0.912088887135174  -1.175822225729652  -0.198960889175684  -0.029907428202692  -0.000255284465680 | -2.632544146312859  -0.031321560983238  -0.000114265730688  -0.749800034971297  -0.912253009177874  -1.175493981644252  -0.199186811785869  -0.029616956275312  -0.000114124394406 | -2.632544178985120  -0.031321552270635  -0.000051016460300  -0.749910721194476  -0.912326510307878  -1.175346979384244  -0.199287959304693  -0.029486909465395  -0.000051050701659 |
| No. or inter | 14 | 18 | 11 | 9 | 7 | 9 |
| exit-  flag | 2 | 1 | 2 | 2 | 2 | 2 |

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| SUMT Linear Extended Interior Penalty (contd.) | | | | | | |
| P | 13 | 14 | 15 | 16 | 17 | 18 |
| rp | 1.043257947200641e-07 | 2.086515894401282e-08 | 4.173031788802563e-09 | 8.346063577605127e-10 | 1.669212715521025e-10 | 3.338425431042051e-11 |
| x0 | 1.210848059661707 13.999285769555806 0.876734896921222 | .210848060519287 13.999680238393443 0.876407262920070 | 1.210848060610322 13.999856141842171 0.876260686095742 | 1.210848060613061 13.999935357586557 0.876195182975888 | 1.210848060613061 13.999933541764523 0.876186705813254 | 1.210848060613061 13.999933117801678 0.876183349749345 |
| x\* | .210848060519287 13.999680238393443  .876407262920070 | 1.210848060610322 13.999856141842171  0.876260686095742 | .210848060613061 13.999935357586557  .876195182975888 | 1.210848060613061 13.999933541764523 0.876186705813254 | 1.210848060613061 13.999933117801678 0.876183349749345 | 1.210848060613061 13.999932794893834  0.876182044674636 |
| f(x\*) | 99.982924965287467 | 99.977876251023361 | 99.975628700368688 | 99.975165477381864 | 99.974986302163842 | 99.974914369053806 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.632544181557862  -0.031321551584570  -0.000022840114754  -0.749960029799180  -0.912359273707993  -1.175281452584014  -0.199333068828654  -0.029428911506017  -0.000022887989043 | -2.632544181830967  -0.031321551511742  -0.000010275582702  -0.749982017730271  -0.912373931390426  -1.175252137219148  -0.199353284168184  -0.029402920355192  -0.000010203999392 | -2.632544181839183  -0.031321551509551  -0.000004617315246  -0.749991919698320  -0.912380481702411  -1.175239036595177  -0.199362283678222  -0.029391349556573  -0.000004621901222 | -2.632544181839183  -0.031321551509551  -0.000004747016820  -0.749991692720565  -0.912381329418675  -1.175237341162651  -0.199364138501386  -0.029388964783933  -0.000002175505821 | -2.632544181839183  -0.031321551509551  -0.000004777299880  -0.749991639725210  -0.912381665025065  -1.175236669949869  -0.199364855950407  -0.029388042349477  -0.000001249121595 | -2.632544181839183  -0.031321551509551  -0.000004800364726  -0.749991599361729  -0.912381795532536  -1.175236408934927  -0.199365143983386  -0.029387672021360  -0.000000866300566 |
| No. or inter | 7 | 9 | 7 | 2 | 2 | 1 |
| exit-  flag | 2 | 2 | 2 | 2 | 2 | 2 |

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| --- | --- | --- | --- | --- | --- | --- |
| ALM | | | | | | |
| P | 1 | 2 | 3 | 4 | 5 | 6 |
| rp | 1 | 5 | 25 | 125 | 625 | 3125 |
| x0 | 0.350113005416948 8.217596212161899 -2.530475785010287 | 1.276756989556942 14.282393517682941 -2.921714790819759 | 1.415339832204870 15.759311463018443 -2.577782321399998 | 1.577158568494572 17.658668240467161 -1.689690306605792 | 1.408995023308075 16.087967822291439 -0.481294436641496 | 1.265605409167405 14.591070975135302 0.444008032949034 |
| x\* | 1.276756989556942 14.282393517682941 -2.921714790819759 | 1.415339832204870 15.759311463018443 -2.577782321399998 | 1.577158568494572 17.658668240467161 -1.689690306605792 | 1.408995023308075 16.087967822291439 -0.481294436641496 | 1.265605409167405 14.591070975135302 0.444008032949034 | 1.237628759681719 14.185728965995825 0.727283434437060 |
| f(x\*) | 0.042441647159707 | 1.503066214958353 | 18.175845003904250 | 55.742698476949712 | 85.730125514583094 | 94.911527329259371 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.830270968670827 0.021405591645554 0.020170965548781 -0.785299189710368 -1.292171479081976 -0.415657041836048 -0.982605831141177 0.977636068610084 0.978980324117700 | -3.246019496614610 0.132271865763896 0.125665104501317 -0.969913932877305 -1.257778232140000 -0.484443535720000 -0.885250947470214 0.852465503890276 0.861975812157810 | -3.731475705483716 0.261726854795657 0.261333445747654 -1.207333530058395 -1.168969030660579 -0.662061938678842 -0.555346221114698 0.428302284290326 0.462183456018077 | -3.226985069924226 0.127196018646460 0.149140558735103 -1.010995977786430 -1.048129443664150 -0.903741112671701 -0.304330799695254 0.105568171036755 0.141927293274670 | -2.796816227502215 0.012484327333924 0.042219355366807 -0.823883871891913 -0.955599196705097 -1.088801606589807 -0.225066608955370  0.003657068656904 0.034876690638764 | -2.712886279045156  -0.009896992254625  0.013266354713988  -0.773216120749478  -0.927271656556294 -1.145456686887412  -0.202649636798318  -0.025164752687877  0.012720671491172 |
| No. or inter | 14 | 11 | 10 | 12 | 11 | 15 |
| exit-  flag | 1 | 1 | 1 | 1 | 1 | 2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ALM (contd.) | | | | |
| P | 7 | 8 | 9 | 10 |
| rp | 15625 | 78125 | 390625 | 1953125 |
| x0 | 1.237628759681719 14.185728965995825 0.727283434437060 | 1.237628759681719 14.005500456065775 0.872171151912445 | 1.237628759681719 14.000029126364613 0.876120282958519 | 1.237628759681719 13.999999657710770 0.876141650918566 |
| x\* | 1.237628759681719 14.005500456065775 0.872171151912445 | 1.237628759681719 14.000029126364613 0.876120282958519 | 1.237628759681719 13.999999657710770 0.876141650918566 | 1.237628759681719 13.999999659075149 0.876141664870233 |
| f(x\*) | 99.847492383823834 | 99.973104250604877 | 99.973785629943563 | 99.973786369114805 |
| g1(x\*)  g2(x\*) g3(x\*)  g4(x\*)  g5(x\*)  g6(x\*)  g7(x\*)  g8(x\*)  g9(x\*) | -2.712886279045156 -0.009896992254625 0.000392889718984 -0.750687557008222 -0.912782884808755 -1.174434230382489 -0.182178927944464 -0.051484235499974 0.000239168407692 | -2.712886279045156 -0.009896992254625 0.000002080454615 -0.750003640795577 -0.912387971704148 -1.175224056591704 -0.181664664939527 -0.052145430792037 0.000001305815426 | -2.712886279045156 -0.009896992254625 -0.000000024449231 -0.749999957213846 -0.912385834908143 -1.175228330183713 -0.181661876210281 -0.052149016301068 0.000000002916323 | -2.712886279045156 -0.009896992254625 -0.000000024351775 -0.749999957384394 -0.912385833512977 -1.175228332974047 -0.181661873185027 -0.052149020190679 -0.000000000877958 |
| No. or inter | 11 | 4 | 4 | 1 |
| exit-  flag | 1 | 2 | 5 | 5 |