МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

«Санкт-Петербургский национальный исследовательский университет

информационных технологий, механики и оптики»

Факультет информационных технологий и программирования

Кафедра информационных систем

Лабораторная работа № 1

**Методы одномерной и многомерной оптимизации**

Выполнил студент группы № М3307:   
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Санкт-Петербург

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Дихотомия

it # 0: l = -1000.000000; m1 = -0.006667; m2 = 0.006667; r = 1000.000000

it # 0: f(l) = 1004004.000000; f(m1) = 4.026711; f(m2) = 3.973378; f(r) = 996004.000000

it # 1: l = -0.006667; m1 = 499.990000; m2 = 500.003333; r = 1000.000000

it # 1: f(l) = 4.026711; f(m1) = 247994.040100; f(m2) = 248007.320011; f(r) = 996004.000000

it # 2: l = -0.006667; m1 = 249.991667; m2 = 250.005000; r = 500.003333

it # 2: f(l) = 4.026711; f(m1) = 61499.866736; f(m2) = 61506.480025; f(r) = 248007.320011

it # 3: l = -0.006667; m1 = 124.992500; m2 = 125.005833; r = 250.005000

it # 3: f(l) = 4.026711; f(m1) = 15127.155056; f(m2) = 15130.435034; f(r) = 61506.480025

it # 4: l = -0.006667; m1 = 62.492917; m2 = 62.506250; r = 125.005833

it # 4: f(l) = 4.026711; f(m1) = 3659.392967; f(m2) = 3661.006289; f(r) = 15130.435034

it # 5: l = -0.006667; m1 = 31.243125; m2 = 31.256458; r = 62.506250

it # 5: f(l) = 4.026711; f(m1) = 855.160360; f(m2) = 855.940354; f(r) = 3661.006289

it # 6: l = -0.006667; m1 = 15.618229; m2 = 15.631562; r = 31.256458

it # 6: f(l) = 4.026711; f(m1) = 185.456166; f(m2) = 185.819496; f(r) = 855.940354

it # 7: l = -0.006667; m1 = 7.805781; m2 = 7.819115; r = 15.631562

it # 7: f(l) = 4.026711; f(m1) = 33.707096; f(m2) = 33.862095; f(r) = 185.819496

it # 8: l = -0.006667; m1 = 3.899557; m2 = 3.912891; r = 7.819115

it # 8: f(l) = 4.026711; f(m1) = 3.608318; f(m2) = 3.659151; f(r) = 33.862095

it # 9: l = -0.006667; m1 = 1.946445; m2 = 1.959779; r = 3.912891

it # 9: f(l) = 4.026711; f(m1) = 0.002868; f(m2) = 0.001618; f(r) = 3.659151

it #10: l = 1.946445; m1 = 2.923001; m2 = 2.936335; r = 3.912891

it #10: f(l) = 0.002868; f(m1) = 0.851931; f(m2) = 0.876723; f(r) = 3.659151

it #11: l = 1.946445; m1 = 2.434723; m2 = 2.448057; r = 2.936335

it #11: f(l) = 0.002868; f(m1) = 0.188984; f(m2) = 0.200755; f(r) = 0.876723

it #12: l = 1.946445; m1 = 2.190584; m2 = 2.203918; r = 2.448057

it #12: f(l) = 0.002868; f(m1) = 0.036322; f(m2) = 0.041582; f(r) = 0.200755

it #13: l = 1.946445; m1 = 2.068515; m2 = 2.081848; r = 2.203918

it #13: f(l) = 0.002868; f(m1) = 0.004694; f(m2) = 0.006699; f(r) = 0.041582

it #14: l = 1.946445; m1 = 2.007480; m2 = 2.020813; r = 2.081848

it #14: f(l) = 0.002868; f(m1) = 0.000056; f(m2) = 0.000433; f(r) = 0.006699

it #15: l = 1.946445; m1 = 1.976963; m2 = 1.990296; r = 2.020813

it #15: f(l) = 0.002868; f(m1) = 0.000531; f(m2) = 0.000094; f(r) = 0.000433

it #16: l = 1.976963; m1 = 1.992221; m2 = 2.005555; r = 2.020813

it #16: f(l) = 0.000531; f(m1) = 0.000061; f(m2) = 0.000031; f(r) = 0.000433

it #17: l = 1.992221; m1 = 1.999851; m2 = 2.013184; r = 2.020813

it #17: f(l) = 0.000061; f(m1) = 0.000000; f(m2) = 0.000174; f(r) = 0.000433

it #18: l = 1.992221; m1 = 1.996036; m2 = 2.009369; r = 2.013184

it #18: f(l) = 0.000061; f(m1) = 0.000016; f(m2) = 0.000088; f(r) = 0.000174

Золотое сечение:

it # 0: l = -1000.000000; m1 = -236.067977; m2 = 236.067977; r = 1000.000000

it # 0: f(l) = 1004004.000000; f(m1) = 56676.361911; f(m2) = 54787.818091; f(r) = 996004.000000

it # 1: l = -236.067977; m1 = 236.067977; m2 = 527.864045; r = 1000.000000

it # 1: f(l) = 56676.361911; f(m1) = 54787.818091; f(m2) = 276532.993824; f(r) = 996004.000000

it # 2: l = -236.067977; m1 = 55.728090; m2 = 236.067977; r = 527.864045

it # 2: f(l) = 56676.361911; f(m1) = 2886.707655; f(m2) = 54787.818091; f(r) = 276532.993824

it # 3: l = -236.067977; m1 = -55.728090; m2 = 55.728090; r = 236.067977

it # 3: f(l) = 56676.361911; f(m1) = 3332.532375; f(m2) = 2886.707655; f(r) = 54787.818091

it # 4: l = -55.728090; m1 = 55.728090; m2 = 124.611797; r = 236.067977

it # 4: f(l) = 3332.532375; f(m1) = 2886.707655; f(m2) = 15033.652886; f(r) = 54787.818091

it # 5: l = -55.728090; m1 = 13.155617; m2 = 55.728090; r = 124.611797

it # 5: f(l) = 3332.532375; f(m1) = 124.447802; f(m2) = 2886.707655; f(r) = 15033.652886

it # 6: l = -55.728090; m1 = -13.155617; m2 = 13.155617; r = 55.728090

it # 6: f(l) = 3332.532375; f(m1) = 229.692742; f(m2) = 124.447802; f(r) = 2886.707655

it # 7: l = -13.155617; m1 = 13.155617; m2 = 29.416855; r = 55.728090

it # 7: f(l) = 229.692742; f(m1) = 124.447802; f(m2) = 751.683939; f(r) = 2886.707655

it # 8: l = -13.155617; m1 = 3.105620; m2 = 13.155617; r = 29.416855

it # 8: f(l) = 229.692742; f(m1) = 1.222396; f(m2) = 124.447802; f(r) = 751.683939

it # 9: l = -13.155617; m1 = -3.105620; m2 = 3.105620; r = 13.155617

it # 9: f(l) = 229.692742; f(m1) = 26.067356; f(m2) = 1.222396; f(r) = 124.447802

it #10: l = -3.105620; m1 = 3.105620; m2 = 6.944377; r = 13.155617

it #10: f(l) = 26.067356; f(m1) = 1.222396; f(m2) = 24.446869; f(r) = 124.447802

it #11: l = -3.105620; m1 = 0.733137; m2 = 3.105620; r = 6.944377

it #11: f(l) = 26.067356; f(m1) = 1.604941; f(m2) = 1.222396; f(r) = 24.446869

it #12: l = 0.733137; m1 = 3.105620; m2 = 4.571895; r = 6.944377

it #12: f(l) = 1.604941; f(m1) = 1.222396; f(m2) = 6.614643; f(r) = 24.446869

it #13: l = 0.733137; m1 = 2.199412; m2 = 3.105620; r = 4.571895

it #13: f(l) = 1.604941; f(m1) = 0.039765; f(m2) = 1.222396; f(r) = 6.614643

it #14: l = 0.733137; m1 = 1.639345; m2 = 2.199412; r = 3.105620

it #14: f(l) = 1.604941; f(m1) = 0.130072; f(m2) = 0.039765; f(r) = 1.222396

it #15: l = 1.639345; m1 = 2.199412; m2 = 2.545553; r = 3.105620

it #15: f(l) = 0.130072; f(m1) = 0.039765; f(m2) = 0.297628; f(r) = 1.222396

it #16: l = 1.639345; m1 = 1.985486; m2 = 2.199412; r = 2.545553

it #16: f(l) = 0.130072; f(m1) = 0.000211; f(m2) = 0.039765; f(r) = 0.297628

it #17: l = 1.639345; m1 = 1.853272; m2 = 1.985486; r = 2.199412

it #17: f(l) = 0.130072; f(m1) = 0.021529; f(m2) = 0.000211; f(r) = 0.039765

it #18: l = 1.853272; m1 = 1.985486; m2 = 2.067198; r = 2.199412

it #18: f(l) = 0.021529; f(m1) = 0.000211; f(m2) = 0.004516; f(r) = 0.039765

it #19: l = 1.853272; m1 = 1.934984; m2 = 1.985486; r = 2.067198

it #19: f(l) = 0.021529; f(m1) = 0.004227; f(m2) = 0.000211; f(r) = 0.004516

it #20: l = 1.934984; m1 = 1.985486; m2 = 2.016697; r = 2.067198

it #20: f(l) = 0.004227; f(m1) = 0.000211; f(m2) = 0.000279; f(r) = 0.004516

it #21: l = 1.934984; m1 = 1.966196; m2 = 1.985486; r = 2.016697

it #21: f(l) = 0.004227; f(m1) = 0.001143; f(m2) = 0.000211; f(r) = 0.000279

it #22: l = 1.966196; m1 = 1.985486; m2 = 1.997407; r = 2.016697

it #22: f(l) = 0.001143; f(m1) = 0.000211; f(m2) = 0.000007; f(r) = 0.000279

it #23: l = 1.985486; m1 = 1.997407; m2 = 2.004775; r = 2.016697

it #23: f(l) = 0.000211; f(m1) = 0.000007; f(m2) = 0.000023; f(r) = 0.000279

Фиббоначчи:

it # 1: l = -1000.000000; m1 = -333.333333; m2 = 333.333333; r = 1000.000000

it # 1: f(l) = 1004004.000000; f(m1) = 112448.444444; f(m2) = 109781.777778; f(r) = 996004.000000

it # 2: l = -333.333333; m1 = 200.000000; m2 = 466.666667; r = 1000.000000

it # 2: f(l) = 112448.444444; f(m1) = 39204.000000; f(m2) = 215915.111111; f(r) = 996004.000000

it # 3: l = -333.333333; m1 = -33.333333; m2 = 166.666667; r = 466.666667

it # 3: f(l) = 112448.444444; f(m1) = 1248.444444; f(m2) = 27115.111111; f(r) = 215915.111111

it # 4: l = -333.333333; m1 = -141.025641; m2 = -25.641026; r = 166.666667

it # 4: f(l) = 112448.444444; f(m1) = 20456.333991; f(m2) = 764.026298; f(r) = 27115.111111

it # 5: l = -141.025641; m1 = -23.809524; m2 = 49.450549; r = 166.666667

it # 5: f(l) = 20456.333991; f(m1) = 666.131519; f(m2) = 2251.554643; f(r) = 27115.111111

it # 6: l = -141.025641; m1 = -68.196509; m2 = -23.378582; r = 49.450549

it # 6: f(l) = 20456.333991; f(m1) = 4927.549928; f(m2) = 644.072435; f(r) = 2251.554643

it # 7: l = -68.196509; m1 = -23.276723; m2 = 4.530763; r = 49.450549

it # 7: f(l) = 4927.549928; f(m1) = 638.912740; f(m2) = 6.404763; f(r) = 2251.554643

it # 8: l = -23.276723; m1 = 4.506729; m2 = 21.667097; r = 49.450549

it # 8: f(l) = 638.912740; f(m1) = 6.283691; f(m2) = 386.794702; f(r) = 2251.554643

it # 9: l = -23.276723; m1 = -6.110681; m2 = 4.501055; r = 21.667097

it # 9: f(l) = 638.912740; f(m1) = 65.783144; f(m2) = 6.255274; f(r) = 386.794702

it #10: l = -6.110681; m1 = 4.499715; m2 = 11.056701; r = 21.667097

it #10: f(l) = 65.783144; f(m1) = 6.248575; f(m2) = 82.023836; f(r) = 386.794702

it #11: l = -6.110681; m1 = 0.446622; m2 = 4.499399; r = 11.056701

it #11: f(l) = 65.783144; f(m1) = 2.412985; f(m2) = 6.246994; f(r) = 82.023836

it #12: l = -6.110681; m1 = -2.057978; m2 = 0.446696; r = 4.499399

it #12: f(l) = 65.783144; f(m1) = 16.467188; f(m2) = 2.412753; f(r) = 6.246994

it #13: l = -2.057978; m1 = 0.446714; m2 = 1.994707; r = 4.499399

it #13: f(l) = 16.467188; f(m1) = 2.412698; f(m2) = 0.000028; f(r) = 6.246994

it #14: l = 0.446714; m1 = 1.994702; m2 = 2.951410; r = 4.499399

it #14: f(l) = 2.412698; f(m1) = 0.000028; f(m2) = 0.905181; f(r) = 6.246994

it #15: l = 0.446714; m1 = 1.403423; m2 = 1.994701; r = 2.951410

it #15: f(l) = 2.412698; f(m1) = 0.355905; f(m2) = 0.000028; f(r) = 0.905181

it #16: l = 1.403423; m1 = 1.994701; m2 = 2.360131; r = 2.951410

it #16: f(l) = 0.355905; f(m1) = 0.000028; f(m2) = 0.129695; f(r) = 0.905181

it #17: l = 1.403423; m1 = 1.768853; m2 = 1.994701; r = 2.360131

it #17: f(l) = 0.355905; f(m1) = 0.053429; f(m2) = 0.000028; f(r) = 0.129695

it #18: l = 1.768853; m1 = 1.994701; m2 = 2.134283; r = 2.360131

it #18: f(l) = 0.053429; f(m1) = 0.000028; f(m2) = 0.018032; f(r) = 0.129695

it #19: l = 1.768853; m1 = 1.908435; m2 = 1.994701; r = 2.134283

it #19: f(l) = 0.053429; f(m1) = 0.008384; f(m2) = 0.000028; f(r) = 0.018032

it #20: l = 1.908435; m1 = 1.994701; m2 = 2.048017; r = 2.134283

it #20: f(l) = 0.008384; f(m1) = 0.000028; f(m2) = 0.002306; f(r) = 0.018032

it #21: l = 1.908435; m1 = 1.961750; m2 = 1.994701; r = 2.048017

it #21: f(l) = 0.008384; f(m1) = 0.001463; f(m2) = 0.000028; f(r) = 0.002306

it #22: l = 1.961750; m1 = 1.994701; m2 = 2.015066; r = 2.048017

it #22: f(l) = 0.001463; f(m1) = 0.000028; f(m2) = 0.000227; f(r) = 0.002306

it #23: l = 1.961750; m1 = 1.982115; m2 = 1.994701; r = 2.015066

it #23: f(l) = 0.001463; f(m1) = 0.000320; f(m2) = 0.000028; f(r) = 0.000227

eps = 0.001

avg iters 24

eps = 0.0001

avg iters 33

eps = 1e-05

avg iters 34

eps = 1e-06

avg iters 50

eps = 1e-07

avg iters 51