Trabalho Prático de Pesquisa Operacional

Dupla: Allan Amaral Sant'Anna Rocha (201935001) e Vitória Natália Caetano (201935030)

Otimização de Componentes para Ração de Ruminantes

Variáveis:

x_0 - Algodao_Farelo_39
x_1 - Amido
x_2 - Arroz_Farelo
x_3 - Arroz_Farelo_Deseng
x_4 - Carne_e_Ossos_Farinha_50
x_5 - Citrus_Polpa
x_6 - Mandioca_Integral_Raspa
x_7 - Milho_7_88
x_8 - Milho_Farelo_de_Glúten_60
x_9 - oleo_de_Soja
x_{10} - Soja_Farelo_48
x_{11} - Trigo_Farelo
x_{12} - Lisina_HCL
x_{13} - Metionina
x_{14} - Fosfato_BicAlcico
x_{15} - CalcArio_Calcitico
x_{16} - Sal_Comum
x_{17} - Excipiente

x_{18} - Exigencias

Função objetivo:

$$\min z = 0{,}56x_0 + 1{,}33x_1 + 0{,}46x_2 + 0{,}49x_3 + 0{,}54x_4 + 0{,}45x_5 + 0{,}24x_6 + 0{,}65x_7 + 0{,}88x_8 + 1{,}12x_9 + 0{,}88x_{10} + 0{,}53x_{11} + 4{,}43x_{12} + 3{,}54x_{13} + 2{,}32x_{14} + 0{,}12x_{15} + 0{,}54x_{16} + 0{,}11x_{17}$$

Restrições:

1: *0.8983*x[0] + 0.885*x[1] + 0.8934*x[2] + 0.8972*x[3] + 0.9395*x[4] + 0.8844*x[5] + 0.8767*x[6] + 0.8748*x[7] + 0.9111*x[8] + 0.996*x[9] + 0.8918*x[10] + 0.8838*x[11] + x[12] + x[13] + x[14] + x[15] + x[16] + x[17] >= 0*

2: *39.21*x[0] + 13.13*x[2] + 15.29*x[3] + 50.36*x[4] + 6.37*x[5] + 2.47*x[6] + 7.88*x[7] + 61.07*x[8] + 48.1*x[10] + 15.62*x[11] + 85.81*x[12] + 59.38*x[13] >= 0*

3: *78.73*x[0] + 77.7*x[2] + 77.7*x[3] + 81.5*x[4] + 27.7*x[5] + 46.0*x[6] + 87.0*x[7] + 94.0*x[8] + 91.4*x[10] + 77.0*x[11] >= 0*

4: *30.87*x[0] + 10.2*x[2] + 11.88*x[3] + 41.04*x[4] + 1.76*x[5] + 1.14*x[6] + 6.86*x[7] + 57.41*x[8] + 43.96*x[10] + 12.03*x[11] >= 2950*

5: *1.37*x[0] + 14.49*x[2] + 1.65*x[3] + 12.65*x[4] + 2.02*x[5] + 0.59*x[6] + 3.65*x[7] + 2.3*x[8] + 99.6*x[9] + 1.45*x[10] + 3.5*x[11] >= 19.8*

6: *0.85*x[0] + 0.785*x[2] + 0.62*x[3] + 0.7*x[4] + 0.2*x[6] + 0.92*x[7] + 0.95*x[8] + 0.95*x[9] + 0.5*x[10] + 0.65*x[11] >= 0*

7: *0.0116*x[0] + 0.1137*x[2] + 0.0102*x[3] + 0.0886*x[4] + 0.0012*x[6] + 0.0336*x[7] + 0.0219*x[8] + 0.9462*x[9] + 0.0073*x[10] + 0.0228*x[11] >=0*

8:*0.0074*x[0] + 0.0237*x[2] + 0.0049*x[3] + 0.0039*x[4] + 0.0045*x[5] + 0.0008*x[6] + 0.0191*x[7] + 0.0121*x[8] + 0.5257*x[9] + 0.0077*x[10] + 0.0154*x[11] >= 1.131*

9: *0.0002*x[2] + 0.0008*x[4] + 0.0008*x[5] + 0.0003*x[7] + 0.0002*x[8] + 0.0694*x[9] + 0.001*x[10] >= 0.452*

10: *0.04*x[0] + 0.877*x[1] + 0.227*x[2] + 0.26*x[3] + 0.6785*x[6] + 0.6266*x[7] + 0.158*x[8] + 0.03*x[10] + 0.3135*x[11] >= 0.826*

11: *0.1397*x[0] + 0.0807*x[2] + 0.1086*x[3] + 0.127*x[5] + 0.0542*x[6] + 0.0173*x[7] + 0.0112*x[8] + 0.0419*x[10] + 0.095*x[11] >= 0.735*

12: *0.294*x[0] + 0.2153*x[2] + 0.243*x[3] + 0.1175*x[6] + 0.1193*x[7] + 0.0639*x[8] + 0.1493*x[10] + 0.401*x[11] >= 0.204*

13: *0.17*x[0] + 0.1258*x[2] + 0.158*x[3] + 0.0427*x[6] + 0.0338*x[7] + 0.0863*x[8] + 0.1228*x[10] + 0.1364*x[11] >= 1.221*

14: *0.2907*x[0] + 0.877*x[1] + 0.4467*x[2] + 0.5184*x[3] + 0.0013*x[4] + 0.611*x[5] + 0.7559*x[6] + 0.7295*x[7] + 0.2502*x[8] + 0.2974*x[10] + 0.5506*x[11] >= 1.515*

15: *0.42*x[0] + 0.971*x[1] + 0.554*x[2] + 0.554*x[3] + 0.93*x[6] + 0.918*x[7] + 0.98*x[8] + 0.27*x[10] + 0.473*x[11] >= 0.882*

16: *0.1221*x[0] + 0.8516*x[1] + 0.2475*x[2] + 0.2872*x[3] + 0.703*x[6] + 0.6697*x[7] + 0.2452*x[8] + 0.0803*x[10] + 0.2604*x[11] >= 0.769*

17: *0.3083*x[0] + 0.0254*x[1] + 0.2799*x[2] + 0.3398*x[3] + 0.1071*x[6] + 0.0771*x[7] + 0.0162*x[8] + 0.259*x[10] + 0.3852*x[11] >= 1.221*

18: *0.8362*x[0] + 0.877*x[1] + 0.8036*x[2] + 0.7964*x[3] + 0.6288*x[4] + 0.8219*x[5] + 0.8407*x[6] + 0.8621*x[7] + 0.8951*x[8] + 0.996*x[9] + 0.8348*x[10] + 0.8368*x[11] >= 0.418*

19: *0.0621*x[0] + 0.0898*x[2] + 0.1008*x[3] + 0.3107*x[4] + 0.0626*x[5] + 0.036*x[6] + 0.0127*x[7] + 0.016*x[8] + 0.057*x[10] + 0.047*x[11] + x[14] + x[15] + x[16] + x[17] >= 0.713*

20: *0.0134*x[0] + 0.014*x[2] + 0.0159*x[3] + 0.0054*x[4] + 0.0075*x[5] + 0.0052*x[6] + 0.0029*x[7] + 0.0013*x[8] + 0.0211*x[10] + 0.0103*x[11] >= 1.301*

21: *0.0011*x[0] + 0.0004*x[2] + 0.0004*x[3] + 0.0059*x[4] + 0.0007*x[5] + 0.0003*x[6] + 0.0002*x[7] + 0.0001*x[8] + 0.0002*x[10] + 0.0002*x[11] + 0.397*x[16] >= 0*

22: *0.0004*x[0] + 0.0006*x[2] + 0.0007*x[3] + 0.006*x[4] + 0.0005*x[5] + 0.0005*x[6] + 0.0006*x[7] + 0.0005*x[8] + 0.0005*x[10] + 0.0006*x[11] + 0.596*x[16] >= 0*

23: *41.7*x[0] + 37.37*x[1] + 43.35*x[2] + 37.4*x[3] + 39.84*x[4] + 37.01*x[5] + 36.21*x[6] + 39.4*x[7] + 50.1*x[8] + 93.33*x[9] + 41.61*x[10] + 39.14*x[11] + 49.01*x[12] + 56.84*x[13] >= 0*

24: *19.47*x[0] + 35.28*x[1] + 25.21*x[2] + 17.95*x[3] + 25.91*x[4] + 11.0*x[5] + 29.73*x[6] + 33.81*x[7] + 36.96*x[8] + 87.9*x[9] + 22.95*x[10] + 17.95*x[11] + 37.62*x[12] + 48.58*x[13] >= 1.04*

25: *20.39*x[0] + 35.36*x[1] + 26.05*x[2] + 18.97*x[3] + 30.05*x[6] + 34.04*x[7] + 37.01*x[8] + 23.73*x[10] + 19.11*x[11] + 37.62*x[12] + 48.58*x[13] >= 0*

26: *20.39*x[0] + 35.36*x[1] + 26.05*x[2] + 18.97*x[3] + 30.05*x[6] + 34.04*x[7] + 37.01*x[8] + 23.73*x[10] + 19.11*x[11] + 37.62*x[12] + 48.58*x[13] >= 0*

27: *0.0047*x[0] + 0.002*x[2] + 0.0025*x[3] + 0.0054*x[4] + 0.0015*x[7] + 0.0133*x[8] + 0.006*x[10] + 0.0018*x[11] + 0.992*x[13] >= 0*

28: *0.0094*x[0] + 0.0038*x[2] + 0.0043*x[3] + 0.0092*x[4] + 0.0029*x[7] + 0.0227*x[8] + 0.0122*x[10] + 0.0043*x[11] >= 0*

29: *0.0098*x[0] + 0.0035*x[2] + 0.0042*x[3] + 0.0129*x[4] + 0.0027*x[7] + 0.0192*x[8] + 0.0165*x[10] + 0.0037*x[11] >= 0*

30: *0.0036*x[0] + 0.0012*x[2] + 0.0014*x[3] + 0.0022*x[4] + 0.0005*x[7] + 0.0029*x[8] + 0.0061*x[10] + 0.0019*x[11] >= 0*

31: *0.0396*x[0] + 0.0085*x[2] + 0.0097*x[3] + 0.0326*x[4] + 0.0034*x[7] + 0.0188*x[8] + 0.0326*x[10] + 0.0093*x[11] >= 0*

32: *0.0254*x[0] + 0.011*x[2] + 0.0127*x[3] + 0.0728*x[4] + 0.006*x[7] + 0.042*x[8] + 0.0423*x[10] + 0.0097*x[11] >= 0*

33: *0.0135*x[0] + 0.0053*x[2] + 0.0062*x[3] + 0.0183*x[4] + 0.0033*x[7] + 0.0268*x[8] + 0.0208*x[10] + 0.0052*x[11] >= 0*

34: *0.0095*x[0] + 0.0034*x[2] + 0.004*x[3] + 0.0121*x[4] + 0.0024*x[7] + 0.0239*x[8] + 0.0205*x[10] + 0.0037*x[11] >= 0*

35: *0.0185*x[0] + 0.0071*x[2] + 0.0082*x[3] + 0.0243*x[4] + 0.009*x[7] + 0.1035*x[8] + 0.034*x[10] + 0.0073*x[11] >= 0.758*

36: *0.0089*x[0] + 0.0028*x[2] + 0.0033*x[3] + 0.0068*x[4] + 0.0021*x[7] + 0.0119*x[8] + 0.0114*x[10] + 0.0034*x[11] >= 0*

37: *0.0189*x[0] + 0.0044*x[2] + 0.0051*x[3] + 0.0121*x[4] + 0.0034*x[7] + 0.0374*x[8] + 0.0231*x[10] + 0.0047*x[11] >= 0*

38: *0.0266*x[0] + 0.0078*x[2] + 0.0085*x[3] + 0.021*x[4] + 0.0058*x[7] + 0.0695*x[8] + 0.0386*x[10] + 0.0077*x[11] >= 0.354*

39: *0.0043*x[0] + 0.0011*x[2] + 0.001*x[3] + 0.1056*x[4] + 0.0157*x[5] + 0.002*x[6] + 0.0003*x[7] + 0.0003*x[8] + 0.0031*x[10] + 0.0014*x[11] + 0.245*x[14] + 0.377*x[15] >= 0*

40: *0.0103*x[0] + 0.0167*x[2] + 0.0189*x[3] + 0.0528*x[4] + 0.002*x[5] + 0.0009*x[6] + 0.0025*x[7] + 0.0047*x[8] + 0.0063*x[10] + 0.0097*x[11] + 0.185*x[14] >= 0.2*

41: *0.0059*x[0] + 0.0143*x[2] + 0.0161*x[3] + 0.0013*x[5] + 0.0006*x[6] + 0.0019*x[7] + 0.0041*x[8] + 0.0039*x[10] + 0.0064*x[11] >= 0.18*

42: *0.0044*x[0] + 0.0024*x[2] + 0.0028*x[3] + 0.0475*x[4] + 0.0007*x[5] + 0.0003*x[6] + 0.0006*x[7] + 0.0006*x[8] + 0.0024*x[10] + 0.0033*x[11] + 0.185*x[14] >= 0.58*

43: *0.0039*x[0] + 0.0048*x[2] + 0.0055*x[3] + 0.0327*x[4] + 0.0012*x[6] + 0.0011*x[7] + 0.0015*x[8] + 0.0028*x[10] + 0.0048*x[11] + 0.129*x[14] >= 0*

44: *0.0048*x[0] + 0.0081*x[2] + 0.0075*x[3] + 0.0042*x[4] + 0.0009*x[6] + 0.0009*x[7] + 0.0006*x[8] + 0.0023*x[10] + 0.0043*x[11] + 0.0091*x[14] + 0.0023*x[15] >= 0*

45: *0.0033*x[0] + 0.0016*x[2] + 0.0017*x[3] + 0.0089*x[4] + 0.0053*x[7] + 0.0053*x[8] + 0.0021*x[11] >= 0*

46: *10.5*x[0] + 28.2*x[2] + 14.7*x[3] + 8.5*x[4] + 4.5*x[6] + 2.1*x[7] + 19.1*x[8] + 15.0*x[11] + 11.7*x[14] >= 55*

47: *157.9*x[0] + 115.4*x[2] + 170.1*x[3] + 247.7*x[4] + 92.6*x[6] + 23.5*x[7] + 112.9*x[8] + 168.0*x[10] + 141.9*x[11] + 4023.0*x[14] > == 77*

48: *14.3*x[0] + 194.5*x[2] + 170.3*x[3] + 20.0*x[4] + 23.9*x[6] + 5.3*x[7] + 3.1*x[8] + 31.7*x[10] + 102.7*x[11] + 284.2*x[14] >= 0.33*