

toryB_widgets_5 2062.33339 -6.05000 1104.87647 -6.05000 7.73035e+06 Fac

_Material_2_limits_time_3 -6.05000 +Inf 2385.63682 -6.05000 7.73035e+06 Fac

toryA_flugets_5 BS 1015.05862 -6.05000 415.12242 -29.82249 7.70622e+06 Fac

toryB_widgets_5 -531.02833 +Inf 1972.51775 -6.05000 7.73035e+06 Fac

53 storage_factoryA_flugets_1 NL -6.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_2 -531.02833 +Inf 524.52833 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_1 -6.50000 -Inf 7.73035e+06 Inf

54 storage_factoryA_flugets_2 NL -6.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_3 -6.50000 +Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_2 -6.50000 -Inf 7.73035e+06 Inf

55 storage_factoryA_flugets_3 NL -6.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_4 -6.50000 +Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_3 -6.50000 -Inf 7.73035e+06 Inf

56 storage_factoryA_flugets_4 NL -6.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_5 -6.50000 +Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_4 -6.50000 -Inf 7.73035e+06 Inf

57 storage_factoryA_flugets_5 NS -6.50000 -3.56684 -Inf 7.7297e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_3 -181.37833 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_5 -6.50000 -Inf 7.73035e+06 Inf

58 storage_factoryA_widgets_1 BS 70.00000 -5.50000 61.85249 -248.27489 7.71336e+06 sto

rage_factoryA_widgets_1 -5.50000 +Inf 70.00000 +Inf +Inf

59 storage_factoryA_widgets_2 BS 68.43621 -5.50000 18.43621 -5.70000 7.73034e+06 sto

rage_factoryB_widgets_2 -5.50000 +Inf 70.00000 10.27853 7.73143e+06 Raw

_Material_2_limits_time_2 -5.50000 -Inf 7.73035e+06 Inf

60 storage_factoryA_widgets_3 NL -5.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_4 -5.50000 +Inf 6.93699 7.73031e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -5.50000 -Inf 7.73035e+06 Inf

GLPK 4.65 - SENSITIVITY ANALYSIS REPORT

Page 15

Problem:

Objective: OBJ = 7730351.199 (MAXimum)

No.	Column name	St	Activity	Obj coef	Lower bound	Activity	Obj coef	Obj value at Lim
iting				Marginal	Upper bound	range	range	break point var

61 storage_factoryA_widgets_4 NL -5.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_5 -5.50000 +Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_4 -5.50000 -Inf 7.73035e+06 Inf

62 storage_factoryA_widgets_5 NS -5.50000 -2.69495 -Inf 7.73449e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -5.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_5 -5.50000 +Inf 7.73035e+06 Inf

63 storage_factoryA_widgets_1 NL -7.50000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_2 -7.50000 +Inf 8.14751 235.27489 7.72837e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_2 -7.50000 -Inf 7.73035e+06 Inf

64 storage_factoryA_widgets_2 NL -7.50000 -8.14751 -Inf 7.73042e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_2 -7.50000 +Inf 1.29844 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_2 -7.50000 -Inf 7.73035e+06 Inf

65 storage_factoryB_widgets_3 NL -7.50000 -8.98926 -Inf 7.73042e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_3 -7.50000 +Inf 26.62174 7.73015e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -7.50000 -Inf 7.73035e+06 Inf

66 storage_factoryB_widgets_4 NL -7.50000 -41.75259 -Inf 7.73066e+06 mar

keting_flugets_4 -7.50000 +Inf 44.69775 7.73024e+06 mar

67 storage_factoryA_widgets_5 NS -7.50000 -3.12558 -Inf 7.73284e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -7.50000 -Inf 7.72971e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_4 -7.50000 +Inf 2.75071 7.72816e+06 Inf

68 storage_factoryB_widgets_1 NL -7.00000 -1.56379 -Inf 7.7311e+06 Fac

tory_A_Storage_limit_time_2 -797.38833 +Inf 10.35638 790.38833 7.72209e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_3 -7.00000 -Inf 7.73035e+06 Inf

69 storage_factoryB_widgets_2 NL -7.00000 -108.75233 -Inf 7.7311e+06 mar

keting_flugets_2 -7.00000 +Inf 50.00000 7.73e+06 Fac

tory_B_Storage_limit_time_2 -7.00000 -Inf 7.73035e+06 Inf

70 storage_factoryB_widgets_3 NL -7.00000 -51.00802 -Inf 7.73071e+06 mar

keting_flugets_3 -7.00000 +Inf 50.00000 7.73e+06 Fac

tory_B_Storage_limit_time_3 -7.00000 -Inf 7.73035e+06 Inf

GLPK 4.65 - SENSITIVITY ANALYSIS REPORT

Page 16

Problem:

Objective: OBJ = 7730351.199 (MAXimum)

No.	Column name	St	Activity	Obj coef	Lower bound	Activity	Obj coef	Obj value at Lim
iting				Marginal	Upper bound	range	range	break point var

71 storage_factoryB_widgets_4 NL -7.00000 -47.64706 -Inf 7.73068e+06 mar

keting_flugets_4 -7.00000 +Inf 50.00000 7.73e+06 Fac

tory_B_Storage_limit_time_4 -7.00000 -Inf 7.73035e+06 Inf

72 storage_factoryB_widgets_5 NS -7.00000 -3.56684 -Inf 7.72971e+06 In

lows_Balanced_for_Factory_B_widgets_time_4 -7.00000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_A_widgets_time_4 -7.00000 +Inf 3.13904 7.73024e+06 Inf

73 storage_factoryB_widgets_1 BS 50.00000 50.00000 -514.63489 7.7049e+06 sto

rage_factoryB_widgets_1 -5.70000 +Inf 50.00000 +Inf +Inf

74 storage_factoryB_widgets_2 NS -5.70000 -1.56379 -Inf 7.73035e+06 Fac

tory_A_Storage_limit_time_2 -202000 +Inf 50.00000 -5.50000 7.73034e+06 Fac

tory_B_Storage_limit_time_2 -202000 -Inf 7.73035e+06 Inf

75 storage_factoryB_widgets_3 NL -7.00000 -2.34239 -Inf 7.73036e+06 In

lows_Balanced_for_Factory_B_widgets_time_3 -7.00000 +Inf 6.93699 7.73031e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -7.00000 -Inf 7.73035e+06 Inf

76 storage_factoryB_widgets_4 NL -5.70000 -15.14449 -Inf 7.73044e+06 Raw

_Material_2_limits_time_4 -5.70000 +Inf 19.68724 7.73024e+06 Raw

_Material_2_limits_time_5 -5.70000 -Inf 7.73035e+06 Inf

77 storage_factoryB_widgets_5 NS -7.00000 -2.69495 -Inf 7.73449e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -7.00000 -Inf 7.72971e+06 In

lows_Balanced_for_Factory_A_widgets_time_4 -7.00000 +Inf 2.37172 7.72671e+06 Inf

78 storage_factoryB_widgets_1 NL -7.80000 -1.93522 -Inf 7.73134e+06 Fac

tory_A_Storage_limit_time_2 -508.93489 +Inf 501.13489 7.73035e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_1 -7.80000 -Inf 7.73035e+06 Inf

79 storage_factoryB_widgets_2 NL -7.80000 -8.14751 -Inf 7.73042e+06 Fac

tory_A_Storage_limit_time_2 -797.15167 +Inf 34.12470 1.29844 7.73044e+06 Fac

toryB_widgets_3 -9.09844 -Inf 7.73035e+06 Inf

80 storage_factoryB_widgets_3 NL -7.80000 -8.98926 -Inf 7.73042e+06 fac

toryB_widgets_3 -7.80000 +Inf 26.62174 7.73014e+06 fac

toryB_widgets_4 -7.80000 -Inf 7.73035e+06 Inf

GLPK 4.65 - SENSITIVITY ANALYSIS REPORT

Page 17

Problem:

Objective: OBJ = 7730351.199 (MAXimum)

No.	Column name	St	Activity	Obj coef	Lower bound	Activity	Obj coef	Obj value at Lim
iting				Marginal	Upper bound	range	range	break point var

81 storage_factoryB_widgets_4 NL -7.80000 -Inf 7.73035e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_5 -7.80000 +Inf 44.69775 7.73e+06 mar

keting_flugets_3 -7.80000 -Inf 7.73035e+06 Inf

82 storage_factoryB_widgets_5 NS -7.80000 -3.12558 -Inf 7.73284e+06 Inf

lows_Balanced_for_Factory_B_widgets_time_4 -7.80000 -Inf 7.72971e+06 In

lows_Balanced_for_Factory_A_widgets_time_5 -7.80000 +Inf 7.73035e+06 Inf

End of report

The table presents a breakdown of the problem's constraints, as rows in the table, each with a name, status (BS) or non-basic (NL), current activity level, slack, and lower and upper bounds. The table also contains columns for the objective function coefficient range, the activity range, and the objective value at the limiting break point variable, as well as the marginal value. The report shows the results of the analysis of the sensitivity of the optimal solution to changes in the coefficients of the constraints and objective function of the problem.

The problem is a maximization problem with an objective function value of 7730.351199. The report shows information on the status of each constraint, including their activity level, slack, lower and upper bounds, and marginal value.

The report also provides sensitivity information for each variable in the problem, including the range of activity levels over which the current optimal solution remains feasible, the range of coefficients over which the variable remains optimal, and the objective function value at which a new variable will become optimal.

Some of the variables in the problem represent the labor, storage, and production capacity of different factories over five different time periods. The report also shows the sensitivity of the optimal solution to changes in these variables. It also shows the sensitivity of the optimal solution to changes in the availability of raw materials and the production capacity of factories. This report pertains to the optimization problem whose objective is to maximize a value represented by the variable OBJ, which is equal to 7730.351199.

The table shows the constraints that are binding or limiting the optimal objective function value. Constraints that are binding have a finite marginal value, while those that are not have an infinite marginal value. For each constraint, the activity range shows the range over which the constraint can change without affecting the optimal objective function value, while the objective function coefficient range shows the range over which the constraint coefficient can change without affecting the optimal objective function value.

The table shows that some constraints have slack, which means that they are not binding, while others are at their bounds and are therefore binding. The objective value at the limiting variable indicates how much the objective function would change if the constraint is relaxed. The marginal range shows the range of values that the constraint coefficient can take without changing the optimal solution.

The report also shows that the problem has non-binding upper bounds for some variables, which means that increasing the values of these variables would not change the optimal solution. The report also indicates that the problem has binding lower bounds for some variables, which means that decreasing the values of these variables would change the optimal solution.

Here are a few examples that help illustrate what the sensitivity analysis report is showing:

("Inflows_and_Outflows_of_Production_Equalwidgets_time_1"), the Slack value is "", indicating that this constraint is binding (i.e., it is fully utilized and cannot be relaxed any further without impacting the solution). The objective function value at the limiting marginal range is "758238e+06", which means that if the constraint were relaxed and the "Inflow_Balanced_for_FactoryA_widgets_time_1" variable were increased by its marginal range of "210.84211", the objective function value would increase to "8.02808e+06".

("Marketing_Budget"), the variable has a lower bound of "-inf" (negative infinity) and an upper bound of "70000.00000". The objective coefficient is "-.04377", meaning that an increase in this variable would decrease the objective function value. The sensitivity analysis report shows that the objective function value at the lower bound of the variable is "7.73032e+06", while the objective function value at the upper bound is "7.73038e+06". This suggests that increasing the marketing budget from zero to the upper bound would have a small positive impact on the objective function.

("Raw_Material_1_Limits_time_2"), the variable has a lower bound of "-inf" and an upper bound of "140000.00000". The sensitivity analysis report shows that the objective function value at the lower bound of the variable is "7.71729e+06", while the objective function value at the upper bound is "7.73562e+06". This suggests that increasing the raw material limit from its current value to the upper bound would have a positive impact on the objective function.

In []: