Assignment 6

February 26, 2024 1:20 PM

Problem 1

1. Price for manufactures sedans and wagons. The number of vehicles that can be sold each of the next 3 months are shown below. Each sedan sells for $8000 and each wagon for $9000. It costs $6000 to produce a sedan and $7500 to produce a wagon. Every vehicle in inventory at the end of the month incurs an inventory charge, $150 per sedan and $200 per wagon. During each month at most 1500 vehicles can be produced. At the beginning of the first month 1200 sedans and 100 wagons are available.

Month	Sedans	Wagons
1	1100	600
2	1500	700
3	1200	50

Sedan selling price = $8000, Wagon selling price = $9000] → used between SP_i, WP_i and P to get final profit

Sedan production cost = $6000, wagon production cost = $7500] → used between PL_i and SP_i, WP_i as production costs

Sedan inventory charge = $150, wagon inventory charge = $200] → used among SP_i, WP_i as inventory charges

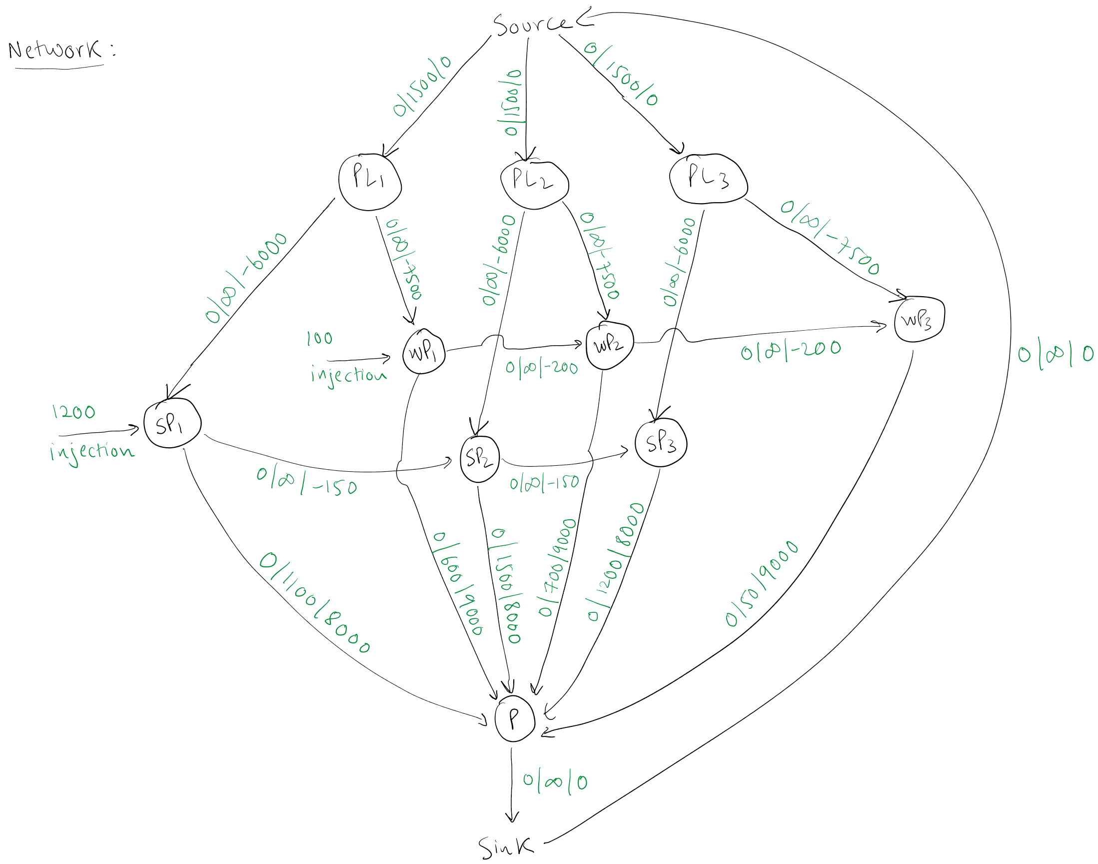
Monthly total production limit = 1500 cars] → used between source and PL_i as monthly limit.

Initial availability = 1200 sedans, 100 wagons.] → as injections for SP_1, WP_1 before month 1 production.

Let PL_i be the production limit for month i
Let SP_i be the sedan production in month i
Let WP_i be the wagon production in month i
$i \in \{1, 2, 3\}$

Let P be the combined production of all sedans and wagons in all months.

Network:



Objective Function

$\boxed{\sum \text{Flows in arcs} * \text{cost of arcs}}$ → 3rd value on each arc

↳ optimal arc flows on gurobi (named C0 to C19 according to arcs listed in dictionary)

Decision variables

Not to be included - as mentioned in lab by TA

Problem Instance solution.

$\boxed{\text{Objective value: } \$17470000 \rightarrow \text{maximised profit.}}$

Problem 2

You are the engineer of a Power-generation company owns 3 hydro-electric power generation stations: A, B and C. The stations are located at reservoirs with dams across the Pristine River. Station A is located 10 Km upstream from station B, and station B is located 20 Km upstream from station C. Water is measured in units of ML and electricity in units of MW. The only entry of water into the Pristine River is at station A, 100 ML in each hour. Water travels down the river at an average speed of

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↓ 100 ML/hr

A

↕ 10Km ↕ 1hr travel time

B

↕ 20Km ↕ 2hr travel time

C

efficiencies

$A_{eff} = 1.5$ MW/ML

$B_{eff} = 4.2$ MW/ML

$C_{eff} = 8.5$ MW/ML

hourly cost $= \lambda_i P_i$ $\left(\frac{\$}{MW} \cdot MW\right)$

Max capacities

50 MW/hr

100 MW/hr

150 MW/hr

No initial water to start!

100 ML every hour.

Question information

8 hour period

costs per hour $\lambda_i = \overset{1}{[}20, \overset{2}{22}, \overset{3}{25}, \overset{4}{30}, \overset{5}{25}, \overset{6}{20}, \overset{7}{20}, \overset{8}{20}]$, $i \in \{1, \dots, 8\}$.] → Used to get hourly cost at each generator

efficiencies of the 3 generators : $[\overset{A}{1.5}, \overset{B}{4.2}, \overset{C}{8.5}]$] → used to get energy generated at each generator

Max energy capacity per hour for all generators : $[\overset{A}{50}, \overset{B}{100}, \overset{C}{150}]$] → Used to cap max energy per hour at each generator.

Let A_i be the ML of water flow in A at hour i , $i \in \{1, \dots, 8\}$] → Used among A_is for storage flow, and to AB_i's, B_i's for spill and usage flow

Let B_i be the ML of water flow in B at hour i , $i \in \{2, \dots, 8\}$] → Used among B_is for storage flow, and to BC_i's, C_i's for spill and usage flow

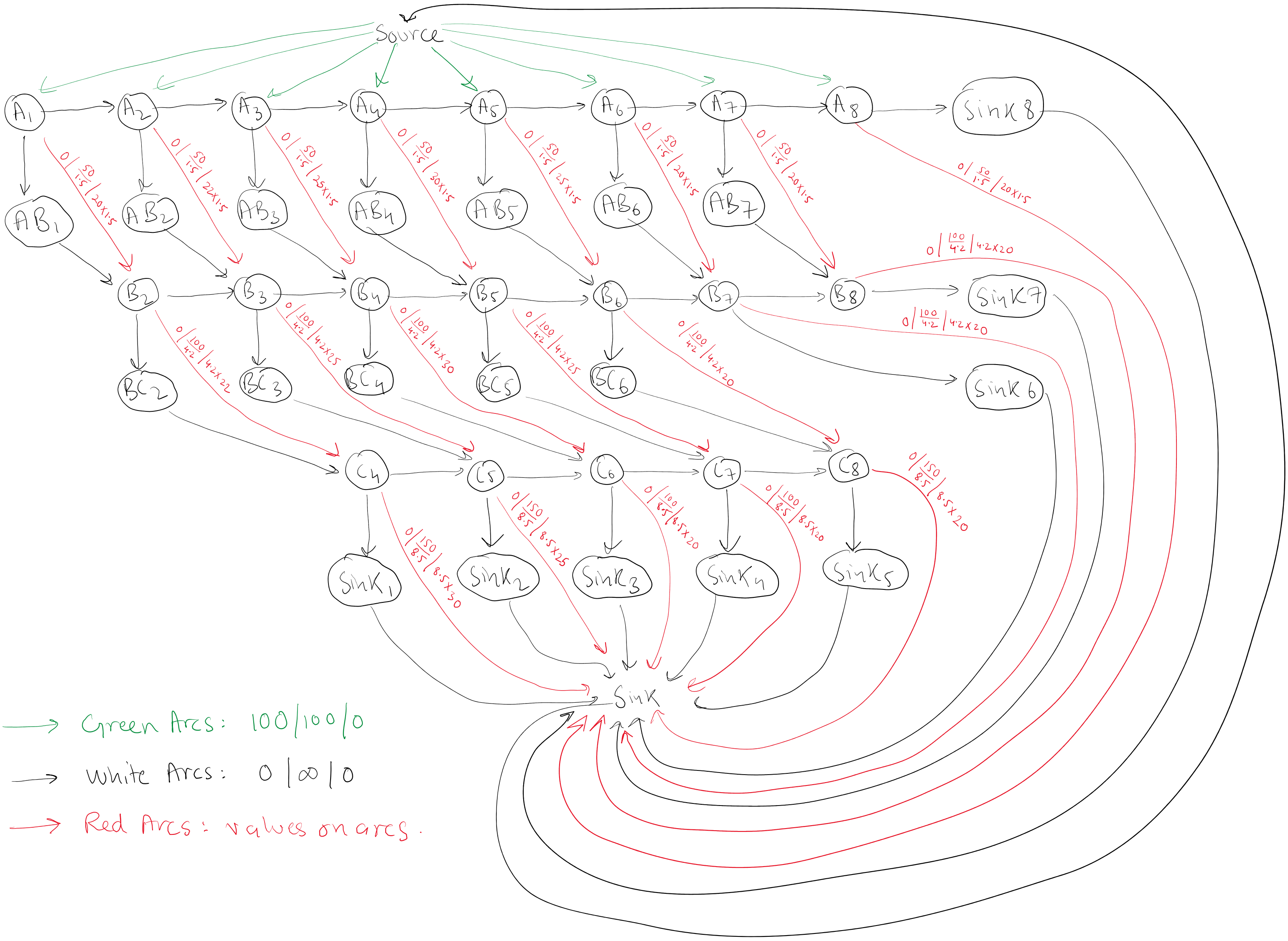
Let C_i be the ML of water flow in C at hour i , $i \in \{4, \dots, 8\}$] → Used among C_i's for storage flow, and $Sink_i$, $i \in \{1, 5\}$ for spill, sink for usage

Let AB_i be the ML of water flow spilled from A to B at hour i , $i \in \{1, \dots, 7\}$] → used between A_i's, B_i's for spill flow

Let BC_i be the ML of water flow spilled from B to C at hour i , $i \in \{2, \dots, 6\}$] → Used between B_i's, C_i's for spill flow

Let $Sink_i$ be the ML of water flow from C at hours 4 to 8, B at hours 7, 8, and A at hour 8] → Used between $C_4, C_5, C_6, C_7, C_8, B_7, B_8, A_8$ and sink for spill flow

<u>Network</u>



Objective Function

$\sum$ Flows in arcs * cost of arcs → 3rd value on each arc

↳ optimal arc flows on gurobi (named C0 to C85 according to arcs listed in dictionary)

Decision variables

Not to be included - as mentioned in lab by TA

Problem Instance solution. → changed to GRB.continuous to get optimal flows.

Objective value: \$42550 → maximised revenue.