

## IE 407 – Assignment 1

**Due: November 9<sup>th</sup>, 2021 – 1:40 p.m.**

1) Gulf Coast Electronics is ready to award contracts for printing their annual report. For the past several years, the four-color annual report has been printed by Johnson Printing and Lakeside Litho. A new firm, Benson Printing, has inquired into the possibility of doing a portion of the printing. The quality and the service level provided by Lakeside Litho has been extremely high; in fact, only 0.5% of their reports have had to be discarded because of quality problems. Johnson Printing has also had a high quality level historically, producing an average of only 1% unacceptable reports. Since Gulf Coast Electronics has had no experience with Benson Printing, they have estimated their defective rate to be 10%. Gulf Coast would like to determine how many reports should be printed by each firm to obtain 75,000 acceptable quality reports. To ensure that Benson Printing will receive some of the contract, management has specified that the number of reports awarded to Benson Printing must be at least 10% of the volume given to Johnson Printing. In addition, the total volume assigned to Benson Printing, Johnson Printing, and Lakeside Litho should not exceed 30,000, 50,000, and 50,000 copies respectively. Because of the long term relationship that has developed with Lakeside Litho, management has also specified that at least 30,000 reports should be awarded to Lakeside Litho. The cost per copy is \$ 2.45 for Benson Printing, \$2.50 for Johnson Printing, and \$2.75 for Lakeside Litho. Formulate an LP for determining how many copies should be assigned to each printing firm to minimize the total cost of obtaining 75,000 acceptable-quality reports.

2) The city of Busville contains three school districts. The number of minority and nonminority students in each district is as follows:

District	Minority Student	Nonminority Student
1	50	200
2	50	250
3	100	150

Notice that of all students, 25% are minority students. The local court has decided that each of the town's two high schools (Cooley High and Whitman High) must have approximately the same percentage of minority students (within  $\pm 5\%$ ) as the entire town.

The distances (in miles) between the school districts and the high schools are as follows:

District	Cooley High	Walt Whitman High
1	1	2
2	2	1
3	1	1

Each high school must have an enrolment of 300-500 students. Formulate an LP to determine an assignment of students to schools that minimizes the total distance students must travel to school.

3) Each day, workers at the Gotham City Police Department work two 6-hour shifts chosen from 12 A.M. to 6 A.M., 6 A.M. to 12 P.M., 12 P.M. to 6 P.M., and 6 P.M. to 12 A.M. The following number of workers are needed in each shift:

12 A.M. to 6 A.M.	6 A.M. to 12 P.M.	12 P.M. to 6 P.M.	6 P.M. to 12 A.M.
15 workers	5 workers	12 workers	6 workers

Workers whose shifts are consecutive are paid \$ 12 per hour; workers whose shifts are not consecutive are paid \$18 per hour. Formulate an LP that can be used to minimize the cost of meeting the daily work-force demands of the Gotham City Police Department.