IG2027-01
Final Exam
18 June 2018

Your Name and Honor Code Signature

1. Write your name and UIN below:

   Name: _____

   UIN: _____

2. Please sign the honor code. Your exam will NOT be graded without your signature.

   "On my honor, as a KIT Engineering Student, I have neither given nor received unauthorized aid on this academic work."

   Signature: _____

Directions

This exam consists of 6 problems for a total of **100 /100** points. The number of total page is 8 pages. **Check your exam now to make sure you have all the problems.** Work as many problems as you can before the end of the exam.

You must clearly show your work including calculation and all formulas used in your solution. Your work needs to be such that someone could reproduce your answer without the use of a financial calculator or spreadsheet. **No credit will be given for a problem where this is not the case.**

Show all work in the spaces provided and make certain that you apply the notation we have been using. In order to receive full or partial credit **your work must be clear and neat.**

Grading Grid

Problem 1 _____ out of 10
Problem 2 _____ out of 10
Problem 3 _____ out of 30
Problem 4 _____ out of 10
Problem 5 _____ out of 30
Problem 6 _____ out of 10

Total _____ out of 100

[Problem 1] - 10 points

Consider a L-Shaped Algorithm. Then, prove the below- optimality cut.
(Hint: Use the dual variables of the original stochastic model)

$$\mathrm{E}_{\mathrm{l}} x + \theta \geq e_l$$

[Problem 2] - 10 points

Consider a L-Shaped Algorithm. Then, prove the below- feasibility cut.
(Hint: Use the dual variables of the original stochastic model)

$$D_l x \geq d_l$$

[Problem 3] - 30 points

Consider the below, stochastic programming. Calculate the optimal solution using L-shaped algorithm (particularly, feasible cut).
You have to submit the computer programming codes and results.

$$\text{Min } 4x_1 + 3x_2 - E_{\xi}[17y_1 + 14y_2]$$
$$\text{s.t. } 4y_1 + 3y_2 \le x_1$$
$$2y_1 + 6y_2 \le x_2$$
$$0.7\xi_1 \le y_1 \le \xi_1$$
$$0.7\xi_2 \le y_2 \le \xi_2$$
$$X, Y \ge 0$$

$$\text{Where, } \xi \begin{cases} (4,4), p_1 = 0.3 \\ (6.4), p_2 = 0.5 \\ (6,8), p_3 = 0.2 \end{cases}$$

[Problem 4] - 10 points

Consider a Monte Carlo method for solving the stochastic problem.

$$\text{Min } f(x) + Q(x, \xi)$$

Suppose that the samples (Sample Size : v) are extracted for $Q(x, \xi^i)$.
Using $Q(X, \xi^i)$, $Q^v(X)$ and $Q^v(X^s)$, estimate the lower bound of the objective function.

(If you need other variables or notations, define and use them.)

[Problem 5] - 30 points

Consider the below, stochastic programming. Calculate the optimal solution using L-shaped algorithm (particularly, optimal cut).
You have to submit the computer programming codes and results.

$$\text{Min } 120x_1 + 140x_2 - E_\xi[q_1y_1 + q_2y_2]$$
$$\text{s.t. } x_1 + x_2 \le 100$$
$$5y_1 + 10y_2 \le 55x_1$$
$$7y_1 + 5y_2 \le 75x_2$$
$$y_1 \le d_1, y_2 \le d_2$$
$$x_1 \ge 40, x_2 \ge 20, Y \ge 0$$

Where, $\xi^T = (d_1, d_2, q_1, q_2)$, $\begin{cases}(500,100,-24,-28), p_1 = 0.4\\(300,300,-28,-32), p_2 = 0.6\end{cases}$

[Problem 6] - 10 points

Formulate a stochastic nonlinear programming with your ongoing research topic. You have to explain clearly the problem statements and definitions of variables / parameters.