# FACULTY OF ECONOMICS AND MANAGMENT Tutorial problem set 2 Operational Research, Third year (Pr. Baye/Pr. Epo/Dr. Mark/Dr. Nana/ Dr. Saleu)

### **Exercise** 1

The Cut-Right Knife Company sells sets of kitchen knives. The Basic Set consists of 2 utility knives and 1 chef's knife. The Regular Set consists of 2 utility knives and 1 chef's knife and 1 bread knife. The Deluxe Set consists of 3 utility knives, 1 chef's knife, and 1 bread knife. Their profit is 30MU on a Basic Set, 40MU on a Regular Set, and 60MU on a Deluxe Set. The factory has on hand 800 utility knives, 400 chef's knives, and 200 bread knives. Assuming all sets are sold, how many of set should be sold to maximize the profit. What is the maximum profit?

## **Exercise 2**

In preparation for the end of year festivities, ZUCHIWO, a Chinese company specialized in manufacturing toys makes two games: Bong and Zong. The manufacturing process requires processing, assembling and packaging. Bong takes 6 hours of processing, 4 hours of assembly and 5 hours packaging. Zong takes 3 hours of processing, 6 hours of assembling and 5 hours of packaging. The manufacturer makes profits of 30Mu on Bong and 20Mu on Zong. If 54 hours are available for processing, 48 hours for assembling and 50 hours for packaging. Formulate the relevant LP model and determine the profit maximizing output mix in terms of equations and inequalities. What is the significance of a non zero optimal value of the slack variable?

#### **Exercise 3**

A small leather manufacturing firm employs a person who is a highly skilled hides and skin cutter, and it wishes to use the person at least 6 hours per day for this purpose. On the other hand, the polishing facilities can be used in any amounts up to 8 hours per day. The firm specializes in three kinds of hides and skin – P, Q, and R. Relevant cutting, polishing, and cost requirements are listed in the table below.

	Р	Q	R
Cutting	2hr	1hr	1hr

Polishing	1hr	1hr	2hr
Unit cost of leather	30MU	30MU	10MU

- a) Formulate the relevant LP model
- b) Formulate its dual
- c) Solve the dual by the Simplex method
- d) Use the dual final tableau to obtain the optimal value of :
  - i. the primal objective function
  - ii. the primal decision and surplus variables

#### Exercise 4:

A stereo manufacturer makes three types of stereos: the standard, quality and deluxe stereo. Its manufacturing requires wiring and encasing. The standard model requires 3 hours for wiring and 1 hour for encasing; the quality model requires 1 hour for wiring and 5 hours for encasing. The deluxe model requires 3 hours for wiring and 2 hours of encasing. Due to the limited availability of man power and resources by the company, they can only afford to pay for 120 hours and 60 hours for wiring and encasing respectively. In each model he makes a profit margin 15Mu, 20Mu and 24Mu for the standard, quality and deluxe models respectively. We are required to

- a. Determine the optimal quantities required to maximize profit.
- b. After defining the shadow price, produce an interpretation from the above exercise
- c. Formulate the dual and without solving, deduce its values from the simplex table.