

## PROJECT V. FASHION STAR

The project will have three parts:

- **Executive Summary:** a one to two page report detailing the conclusions of your modeling written for the client in lay terms.
- **Technical Report:** a more detailed report fully detailing the model and modeling process for a technical reader.
- **Presentation:** a 6-8 minute presentation reporting your problem, assumptions, model, analysis, and conclusions to the client.

These three parts are the communication of your work and the grade is based entirely on these three aspects. Each individual team member must also submit a team evaluation form.

TABLE 1. Teams for Project I

A	B	C	D	E	F
Bing Max Rostom	Rebelsky David	Tristan Harry Andrew	Caleb Jimin Kaiqian	Evan China Henry	Yimin Valerie Royle

**Background.** In this project we will determine production specifications for a clothing designer to optimize profit. This will be modeled as a linear program.

**Problem.** Fashion Star Corporation is attempting to determine the production levels for their fall lines. They seek your input to determine the optimal quantity of each clothing item they should produce given production capacity and material constraints on their operations. Moreover, market testing and past experience provides them with reasonable forecasts for demand of each of their items.

There are two lines of women's fashion they will produce, the *Professional* and *Casual* lines. They have provided the following information regarding both lines.

TABLE 2. Professional Line

Clothing Item	Material Requirements	Price	Machine and Labor Costs
Tailored wool slacks	3 yards of wool 2 yards of acetate for lining	\$300	\$160
Cashmere sweater	1.5 yards of cashmere	\$450	\$150
Silk blouse	1.5 yards of silk	\$180	\$100
Silk camisole	0.5 yards of silk	\$120	\$60
Tailored skirt	2 yards of rayon 1.5 yards of acetate for lining	\$270	\$120
Wool blazer	2.5 yards of wool 1.5 yards of acetate for lining	\$320	\$140

TABLE 3. Casual Line

Clothing Item	Material Requirements	Price	Machine and Labor Costs
Velvet pants	3 yards of velvet 2 yards of acetate for lining	\$350	\$175
Cotton sweater	1.5 yards of cotton	\$130	\$60
Cotton miniskirt	0.5 yards of cotton	\$75	\$40
Velvet shirt	1.5 yards of velvet	\$200	\$160
Button-down blouse	1.5 yards of rayon	\$120	\$90

Last month, Fashion Star completed the design of the fall line and presented it at fashion shows around the globe. The team of six designers were paid \$860,000 for the design projects. The fashion shows are obviously very expensive as they require venues, hair stylists, make-up artists, stage crew, models, prototype clothing, choreography and show management, etc. Fashion Star held three impressive shows in New York, Paris, and Milan; each show cost Fashion Star \$1.2 million to produce.

The information in Tabs. 2 and 3 was obtained through an intensive study of the designs, market research, fashion show reviews, and operational configuration at the Fashion Star production centers. The preparatory work also included securing high quality materials from various suppliers. For the production of the fall lines, Fashion Star has secured 45,000 yards of wool, 28,000 yards of acetate, 9,000 yards of cashmere, 18,000 yards of silk, 30,000 yards of rayon, 20,000 yards of velvet, and 30,000 yards of cotton. The negotiations resulted in the following prices for the material.

TABLE 4. Material Costs

Material	Price per yard
Wool	\$9.00
Acetate	\$1.50
Cashmere	\$60.00
Silk	\$13.00
Rayon	\$2.25
Velvet	\$12.00
Cotton	\$2.50

These prices were negotiated in a way that protects Fashion star: any material that is not used can be returned to the supplier for a full refund. However, only usable material can be returned. Scrap material is lost. The material requirements in Tables 2 and 3 account for scrap material except for the following situations. Since both the silk blouse and cotton sweater require a complicated cutting procedure, 2 yards of silk or cotton are required leaving .5 yards of scrap material. Fortunately, the 0.5 yards of scrap can be used to produce a silk camisole or a cotton miniskirt. In order to not waste the scrap material, whenever a silk blouse is produced, the scrap will be used to produce a silk camisole. Likewise, whenever a cotton sweater is produced a cotton miniskirt should also be made from the scrap. Fashion Star points out that it is still possible to produce a cotton miniskirt without producing a cotton sweater; likewise Fashion Star can produce a silk camisole without producing a silk blouse.

The market research team has produced some demand forecasts for both fashion lines. Some of the products have a limited demand. Velvet clothing is a fad, and demand for velvet pants and shirts will be limited since consumers often skip purchasing fad items. Specifically, Fashion Star forecasts that they will only be able to sell 5,500 pairs of velvet pants and only 6,000 velvet shirts. Because the velvet items are both a fad and expensive, Fashion Star has decided not to produce any velvet items beyond the sales forecasts and are definitely willing to produce less velvet pants and shirts than the forecasted demand. Similarly, cashmere is very expensive and they forecast an ability to sell 4,000 cashmere sweaters. Since silk can be difficult to care for, the silk blouse and camisole also have limited forecasted demand. Fashion Star projects they can sell at most 12,000 silk blouses and 15,000 silk camisoles.

Demand forecasts also indicate that the wool slacks, tailored skirts, and wool blazers are a “must have” item for many professional women. They forecast the demand for wool to be 7,000 pairs of slacks and 5,000 blazers. Fashion Star has a loyal customer base. In order to keep their loyal customers happy they intend to produce at least 60% of the forecasted demand. The demand for tailored skirts had conflicting information; they have therefore decided to produce at least 2,800 tailored skirts based on previous sales.

Fashion Star has asked you to answer the following questions. (Unless specified, examine each question independently of the other questions.)

1. The vice president for sales has suggested that the production team eliminate the velvet shirt from the production line. They estimate that \$500,000 of the design and marketing costs we directly related to velvet shirts. The net contribution to profit for velvet shirts is only \$22 after subtracting all costs from

- the sales price. Using the forecasted demand, the velvet shirts will not cover the \$500,000 design and marketing costs. The production still wants to produce the velvet shirts. Please settle this argument.
2. Given all of the above information, what is the optimal production levels to maximize profit? What is the maximized profit?
  3. The head of acquisitions is concerned that negotiations regarding the return of unused velvet is still unsettled. If the velvet supplier will not accept returns, how does this change the optimal production levels and profit? What is your recommendation regarding the velvet acquisition if changes can still be made to the order?
  4. When producing the clothes for the fashion shows the sewing staff had significant difficulty with the wool blazers since the material is difficult to work with and the arms and lining require complicated cutting and sewing techniques. The sewing staff contends that the labor and machine costs for producing a wool blazer have been underestimated by as much as \$80 per blazer. If the sewing staff is correct, how will this affect the production levels and profit?
  5. The acetate supplier has informed Fashion Star that it may be possible to obtain an additional 10,000 yards of acetate at the same price and with the same return policy. If the supplier is able to provide this extra acetate, will that affect the production levels and profit?
  6. The sales team produced the demand forecasts for selling the fall lines in September and October. Fashion Star has been able to sell any unsold items at its factory closeout stores in years past. However, the factory direct stores are all located in outlet malls and the items are sold at 60% the original cost. The new branding consultant has suggested that Fashion Star eliminate the outlet stores to bolster the Fashion Star brand as a high-end clothing line. Considering both the demand forecasts for the full price clothing lines in September and October and the outlet prices for November and beyond, what should the optimal production levels and what is the maximum profit?

Credit: This project is a case study in F. Hillier and G. Lieberman, *Introduction to Operations Research*, 8th Ed., McGraw-Hill, 2005.