

Problem Statement

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ENGR 491: Engineering Capstone

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Problem Description

Summary Review of Customer

The Gold and Silver Exchange is a small, 5-employee family business. The company buys and sells gold, silver, and other precious metals in the form of bullion, coins, jewelry, and other similar items. The price of each item is calculated based on the *spot price* (the value of precious metals determined by the international market) and the company's *premiums* (the margin determined by the Gold and Silver Exchange that is added to the spot price). See figures 1 and 2 for an example of price calculation.

Gold Spot	Silver Spot	Platinum Spot
\$1,850.34	\$21.03	\$1,445.70
Time Stamp: 10/02/2023 10:40AM		

Figure 1: Market Spot Prices

Gold and Silver Exchange PREMIUMS Sheet					
Gold Bullion	Buy	Sell	Silver Bullion	Buy	Sell
1oz Krugerrand	-\$10.00	\$90	1oz Silver Round	0	\$4
1/2oz Krugerrand	-3%	10%	5oz Silver Bar	-\$0.50	\$3.50
1/4oz Krugerrand	0	15%	10oz Silver Bar	-\$1.00	\$3
1g Gold Bar	-1%	12%	100oz Silver Bar	-\$1.50	\$2
Formula: {spot} + {PREMIUM} = {price per ounce}					
Example price for selling a 1oz silver round:					
silver spot	+	1oz Silver Round Sell	=	Price/oz	
\$21.03	+	\$4	=	\$25.03	

Figure 2: The Gold and Silver Exchange's Premiums

The Problem

The company has two main needs. The first need is for a more efficient mode of conducting transactions. The second need is for a way to track inventory. Both of these can be resolved with the same solution: a computerized Point-of-Sale (POS) System which can be used to facilitate transactions and be connected to a database to track incoming and outgoing items.

Point-of-Sale for Transactions

Currently, employees conduct transactions using hand-written, carbon-paper invoices. There are several problems with this method.

First, it is very time-intensive. Employees must manually write all relevant information down, including an itemized list of what is being bought or sold. For very large transactions, these invoices can span multiple pages, requiring a copious amount of time. Moreover, if the company is conducting a purchase, then the employee must write down the customer identification information in addition to the item information. This consists of the customer's name, address, date of birth, ID or passport number, and the ID or passport expiration date.

Second, these manual invoices are highly prone to clerical error. The employee may misspell or omit important customer information. The employees must calculate the price of each item by looking up the current spot price (which fluctuates every few minutes) and adding the company's premiums. Then, the employee must multiply the item price by the quantity and finally sum all line item totals. The employee may accidentally use an outdated spot price, an incorrect premium, or they may make an arithmetic mistake in multiplying and totaling the prices or calculating sales tax. With paper invoices, there is no computer to double-check the employee's calculations. Thus, if the employee makes a mistake, then it is propagated through

completion of the transaction. This will either result in a loss of money for the company or for the customer, which in turn results in an unprofessional company reputation. Figure 3b illustrates an example of an invoice with clerical mistakes. In the example, the employee misspells the customer's name, accidentally copies the expiration date into the Date-Of-Birth field, and forgets to record the number of the check with which the customer paid. The employee uses the wrong silver and gold spot prices, causing all subsequent prices to be lower than they should be. The employee also incorrectly calculates the price of a 1oz Silver Round by adding a premium of \$3 rather than \$4. Lastly, the employee mistakenly sums the line items as \$1,602 instead of \$1,602.56. After all these calculation errors, the employee charges the customer a total of \$1,750.19 when the total should have been \$1,771.14 as shown in figure 3a.

The Gold and Silver Exchange, LLC			
1800 Sunny Rd, Long Beach CA		(707) 777-7777	
Name: John Carretini		Date: 10/02/2023	
Address: 501 Parkview Lane, Santa Barbara, 95321			
ID: C3501776		Expiration: 05/19/2025	
Phone: (707) 810-9325		DOB: 05/19/1972	
Payment Method: Check #1302			
Silver Spot: \$21.03		Gold Spot: \$1850.34	
Qty	Item	Price	Total
2	1/4oz Gold Krugerrand	\$531.97	\$1,063.95
1	1g Gold Bar		\$66.64
10	1oz Silver Rounds	\$25.03	\$250.30
1	10oz Silver Bar		\$240.30
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Figure 3a: Correct Invoice

The Gold and Silver Exchange, LLC			
1800 Sunny Rd, Long Beach CA		(707) 777-7777	
Name: John Carrettini Carretini		Date: 10/02/2023	
Address: 501 Parkview Lane, Santa Barbara, 95321			
ID: C3501776		Expiration: 05/19/2025	
Phone: (707) 810-9325		DOB: 05/19/2025 1972	
Payment Method: Check omitted check number "#1302"			
Silver Spot: \$20.76 \$21.03		Gold Spot: \$1845.07 \$1850.34	
Qty	Item	Price	Total
2	1/4oz Gold "Krugerrand"	\$530.46	\$1,060.92
1	1g Gold Bar		\$66.45
10	1oz Silver Rounds	\$23.76	\$237.60
1	10oz Silver Bar		\$237.60
incorrect addition of premium: {spot} + {premium} = {price} \$20.76 + \$4 = \$24.76			
Customer signature: John Carretini		Subtotal: \$1,602 \$1602.56	
		Total: \$1,750.19	

Figure 3b: Invoice with clerical Errors

Third, because the employees are writing the item descriptions manually, they may mis-identify an item or use an incorrect description that does not match the company's standard description for that item. This can lead to future confusion when reviewing the invoice. In the example in figure 3b, the employee omits "Krugerrand" from the description so it would be impossible to tell in the future which kind of gold was sold. The generic description of "1/4oz gold" could refer to a Gold Bar or a coin such as a South African Krugerrand, a Canadian Maple Leaf, or an American Eagle.

Fourth, using paper invoices there is no capability for searching transaction or customer history. In some cases, it is necessary to review all past transactions of a certain customer, or all past transactions involving a certain item. With paper invoices, it is nearly impossible and certainly excessively time-consuming to rifle through boxes of hand-written invoices in order to find the relevant transactions.

Lastly, after several years of business, the company has accumulated several boxes of invoices. This takes up very valuable space that the company would like to use as office space or for storing inventory rather than paperwork.

Point-of-Sale for Inventory

The company has no formal inventory system. When items are purchased from customers, employees sort them and put them away in the company safes, however it is not recorded how many of each item is being added to the inventory. The owners rely on estimations of inventory based on observation.

A problem arises when the owners must make decisions about restocking because without an inventory, they will not be able to answer questions such as: *Which items are almost*

gone and need to be replaced? Which items were most popular? Which items should not be replaced because they did not sell well? How much profit did we make on each item? This may cause the owners to overstock an item, taking up more space than is necessary. Or, they may not discover that they have run out of an item until a customer asks to purchase it. Then, the customer will have to wait for the company to order it or they may choose to purchase the item from a competitor that already has it in stock. Moreover, the owners will not know which items are most profitable, so they will not be able to optimize their purchases based on demand.

Another problem with the lack of inventory is that it leaves the company more susceptible to theft or misplacement of items. There will be no way to either detect or prove that items have been stolen since there is no record of how many items the company owns.