PROJECT-6 OPTIMIZING

07.01.2023

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ALY6050 - Enterprise Analytics

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PART-1 : A TRANSSHIPMENT MODEL

Introduction

A transshipment model in enterprise analytics refers to a mathematical optimization approach that analyzes and optimizes the movement of goods or resources within a supply chain or transportation network. This model helps companies make efficient decisions regarding inventory management, transportation planning, and resource allocation. By considering factors such as transportation costs, capacity constraints, and demand at different locations, the model determines the most cost-effective routes, quantities to be transported, and resource allocations. It aims to minimize transportation costs, maximize resource utilization, and improve overall operational efficiency. Transshipment models can be formulated as linear programming problems or network flow problems, employing mathematical equations and network representations to optimize the flow of goods or resources. By utilizing these models, businesses can identify bottlenecks, streamline their supply chain, and make informed decisions to reduce costs and improve performance.

Analysis

Transshipment models in enterprise analytics are utilized to determine the most efficient routes for the movement of goods or resources within a supply chain or transportation network. These models employ advanced analytical theories and concepts to address transshipment issues and minimize risks associated with them.

To identify the most cost-effective paths, these models take into account factors such as transportation costs, capacity constraints, demand at different locations, and resource availability. By considering these factors, businesses can make informed decisions that reduce transportation costs.

Transshipment models leverage various analytical approaches, including predictive, descriptive, and prescriptive analytics. Predictive analytics uses historical data and statistical techniques to forecast future demand and identify supply chain trends. Descriptive analytics focuses on summarizing and visualizing data to gain insights into the current state of the supply chain. Prescriptive analytics employs optimization techniques to recommend optimal actions, such as identifying efficient routes and resource allocation.

Tables are commonly used to present and analyze data related to transportation costs, demand, capacity, and other relevant parameters in transshipment models. Analyzing these tables helps businesses gain a comprehensive understanding of the transshipment issue and make data-driven decisions.

Overall, transshipment models in enterprise analytics offer a systematic and analytical approach to optimize supply chains, reduce costs, and enhance operational efficiency. By employing advanced analytics and considering multiple factors, businesses can identify efficient routes and make informed decisions to improve their logistics and operations management.

	WASTE PROPOSAL SITES		
Plant:	orangeburg_site	florence_site	macon_site
From plant at Denver	$12	$15	$17
From plant at Morganton	$14	$9	10
From plant at Morrisville	$13	$20	11
From plant at Pineville	$17	$16	19
From plant at Rockhill	$7	$14	12
From plant at Statesville	$22	$16	18

Table 1.1 : Expenses associated with the transportation of waste from six plants to three waste disposal sites per unit.

Plant:	Waste per week (bbl)
from Denver plant	45
From Morganton plant	26
From Morrisville plant	42
From pineville plant	53
From rockhill plant	29
From statesville Plant	38

Plant:	denver plant	morganton plant	morrisville plant	pineville plant
From Denver plant	$---	$3	$4	$9
from Morganton Plant	$6	---	7$	6
From Morrisville Plant	5$	7$	---	3
From Pineville plant	5$	4$	3$	---
From Rockhill Plant	5$	9$	5$	3
From Statesville plant	4$	7$	11$	12

Table 1.2 : The cost of shipping per barrel between each of the six plants is outlined as follows.

Waste_Disposal Site:	Orangeburg site	Florence site	Macon site
Orangeburg Disposal site	---	$12	$10
Florence disposal site	$12	---	$15
Macon Disposal site	$10	$15	---

Table 1.3 : The transportation expenses per barrel of garbage between the three waste disposal facilities.

In order to make use of the solver tool, it is necessary to recreate the Excel file. This file contains the essential data for analyzing the estimated expenses associated with transporting each barrel of waste between the newly established rubbish dumping locations. The file includes the estimated costs for transporting each barrel of waste, providing a comprehensive overview of the expenses involved.

By recreating the Excel file, users can update and modify the transportation cost estimates as required. This allows for further analysis, adjustments, and optimization of the waste transportation process. The regenerated file serves as a foundation for utilizing the solver tool, which utilizes the data to determine the most cost-effective and efficient transportation routes for the barrels of waste.

In summary, recreating the Excel file is vital for effectively utilizing the solver tool and accurately assessing the expenses associated with transporting waste between the three rubbish dumping locations.

Plant:	Orangeburg Disposal site	Florence Disposal site	Macon disposal site
Denver	$36	$9	0
Morganton	0	0	$26
Morrisville	0	0	$42
Pineville	0	$53	0
Rockhill	$29	0	0
Statesville	0	$18	$20

Table 1.4 : The expenses incurred for transporting each barrel of waste between the three trash disposal facilities.

The solver produced the optimal solution with a minimum cost of $2,988. Here are the summarized results obtained from utilizing the solver.

Minimum Cost	2988		
Sub to:			
Constraint	LHS	Directions	RHS
orangebur_Capacity	65	<=	65
florence_Capacity	80	<=	80
macon_Capacity	88	<=	105
denver_Transhipment	45	=	45
morganton_Transhipment	26	=	26
morrisville_Transhipment	42	=	42
pineville_Transhipment	53	=	53
rockhill_Transhipment	29	=	29
statesville_Transhipment	38	=	38

A combination of descriptive, predictive, and prescriptive models was utilized to analyze the provided information effectively. These models aimed to sort through the data and make informed decisions. Prescriptive analytics specifically focused on risk minimization and transshipment issues, allowing for the evaluation of various transshipment and hazard board options. Optimal decisions for each scenario were determined through the application of multiplications and stochastic improvements.

Predictive analytics played a key role in addressing inquiries and managing predictions efficiently. It provided timely and accurate answers based on the available data. Additionally, prescriptive analytics was employed to generate future estimates for the transportation of chemical wastes between the source and destination locations.

In summary, a combination of descriptive, predictive, and prescriptive analytics models were utilized to analyze the information, minimize risks, and optimize decision-making in the transshipment and transportation of chemical wastes. These models ensured a comprehensive and data-driven approach to problem-solving.

PART 1-B

The analytics process involved using similar tools as predictive analytics, along with advancements, to complete this stage successfully. A simple LP model was created using Excel Solver, leveraging the data from the table. This model facilitated optimization and decision-making based on defined objectives and constraints.

Min Cost	*$2,674*		
Subject to:			
Constraint	*LHS*	*Directions*	*RHS*
Orangeburg_Capacity	65	<=	65
Florence_Capacity	80	<=	80
Macon_Capacity	88	<=	105
Denver_Transhipment	0	=	0
Morganton _Transhipment	0	=	0
Morrisville_Transhipment	0	=	0
Pineville _Transhipment	0	=	0
Rockhill _Transhipment	0	=	0
Statesville _Transhipment	0	=	0

Based on the calculations obtained using the Excel solver, it is evident that Allen has the opportunity to explore an alternative approach for managing trash. By considering the option of dumping and cleaning up at different facilities and waste sites, Allen can significantly reduce costs compared to directly transporting waste from a manufacturing facility to a landfill.

The direct delivery option incurs a cost of $2,988, whereas opting for the dumping and retrieval approach lowers the total cost to $2,674. This substantial cost difference highlights the potential for significant savings by choosing the latter option.

To arrive at a conclusive decision, a more detailed analysis is required, specifically breaking down the transportation costs per barrel of rubbish. By conducting these calculations, a comprehensive understanding of the expenses associated with each option can be obtained. This breakdown will facilitate a thorough comparison between direct delivery and the dumping and retrieval approach, enabling Allen to make an informed choice based on the financial implications.

By evaluating the transportation costs per barrel, Allen can determine the most cost-effective method for managing waste. This analysis will provide valuable insights into the overall expenses involved and help guide the selection of the optimal approach for waste disposal and transportation.

Plant:	*Orangeburg*	*Florence*	*Macon*
Denver plant			
Morganton plant		80.00	29.00
Morrisville plant			59.00
Pineville plant			
Rockhill	65.00		
Statesville plant			

Furthermore, the overall logistical costs include additional expenses related to the drop-off and pick-up of waste at various disposal facilities. These costs are accounted for in the provided table, which offers a comprehensive breakdown of the specific expenses associated with each facility. The table presents the costs incurred for dropping off and picking up waste at each disposal location separately.

By examining the table, one can gain a detailed understanding of the individual costs attributed to each facility, enabling a thorough assessment of their impact on the overall waste management expenses. This breakdown of costs provides valuable insights for making informed decisions regarding waste disposal strategies.

In summary, the table includes the detailed breakdown of drop-off and pick-up costs, which are part of the overall logistical expenses. Analyzing this information helps to comprehend the specific financial aspects related to waste management at each disposal facility, facilitating decision-making processes in waste disposal and associated expenditures.

Plant:	*Denver plant*	*Morganton plant*	*Morrisville plant*	*Pineville plant*	*Rockhill plant*	*Statesville plant*
Denver plant		45				
Morganton plant						
Morrisville plant						
Pineville plant			17		36	
Rockhill plant						
Statesville plant		38				

After considering various factors, it has been determined that the most cost-efficient way to transfer a total of 286 barrels of rubbish from different factories is at a total cost of $2,674. This calculation takes into account multiple elements, including transportation costs, drop-off and pick-up expenses at disposal facilities, and other associated logistical costs.

By carefully analyzing these factors, a comprehensive understanding of the overall expenses involved in the waste transfer process has been obtained. The determined cost of $2,674 represents the optimal solution for efficiently managing the transfer of 286 barrels of rubbish, ensuring effective resource allocation and minimizing financial burden.

It is important to highlight that this cost estimation has been arrived at by considering all relevant variables and prioritizing cost-effectiveness and overall efficiency in the waste transfer process. By opting for the cheapest option, businesses can make well-informed decisions and effectively utilize their resources.

In summary, through thorough evaluation and analysis, it has been concluded that the most cost-effective approach to transferring 286 barrels of rubbish from various factories is achieved at a total cost of $2,674. This approach considers various factors to ensure efficient resource allocation and minimize overall expenses.

PART-1 Conclusion :

Upon completing a thorough analysis of the available information, several key findings and solutions have emerged. These findings encompass the identification of optimal routes and cost-effective transportation strategies for the transfer of waste barrels.

One significant solution involves leveraging Rockhill as a strategic intermediate point between Morrisville and Pineville on the journey to the final destination. Through careful analysis, it was determined that the route from Denver to Morganton, and then to Florence, offered a highly cost-effective pathway. This particular route stood out among various alternatives as an excellent choice for waste transportation. Another favorable option entailed shipping barrels from Statesville to Denver, as it eliminated the need for additional transportation expenses by designating Denver as a drop-off location.

Moreover, specific cost considerations emerged. Transporting chemicals from Denver to Orangeburg proved to be more cost-efficient compared to other destinations. Similarly, transshipping from Morganton to Florence was identified as a more economical choice compared to routes involving Macon and Orangeburg. Additionally, it was observed that the travel cost from Morrisville to Macon exceeded the costs associated with traveling to Orangeburg and Florence. Similarly, the cost of travel from Rockhill to Orlando was higher compared to the cost of traveling to Macon.

To determine the optimal routes, comprehensive calculations were conducted for the costs associated with the routes from Morganton to Statesville, Denver to Morganton, Pineville to Morrisville, Morrisville to Pineville, and Rockhill. The analysis revealed that certain routes, such as Florence to Orlando, Orlando to Macon, and Macon to Orlando, offered lower shipping costs when transferring barrels between waste sites. This finding proved crucial in utilizing similar waste disposal locations as drop-off points for recyclables.

Taking all factors into consideration, the most cost-effective option for shipping 286 barrels of waste from various facilities amounts to $2,674. This solution optimizes transportation routes, minimizes costs, and promotes efficient waste management practices. By implementing these findings, businesses can make informed decisions to streamline their waste transportation processes and achieve significant savings.

PART-2 : INVESTMENT ALLOCATIONS

During the investment allocation phase, a combination of predictive, descriptive, and prescriptive analytics is utilized to determine the most effective deployment of assets. The primary objective is to generate a favorable return on investment while minimizing risk, aiming for a baseline expected return of 11%.

To gain insights into the expected returns of the portfolio, historical data is examined using descriptive analytics. This involves analyzing the available data in the Investments Table, which provides a comprehensive overview of past investment performance. By studying this data, investors can develop a clearer understanding of the expected outcomes and potential risks associated with different investment options.

To streamline the analysis process, the solver function in Microsoft Excel is employed. The Excel solver is a powerful tool that aids in finding optimal solutions to complex problems. By leveraging this tool, investors can efficiently analyze various investment scenarios and generate meaningful outcomes.

The results obtained from the Excel solver provide valuable insights into the investment allocation strategy. These outcomes help determine the most favorable asset allocation that balances the desired return on investment with the need to mitigate risk. By considering these results, investors can make informed decisions about the allocation of their assets to optimize their portfolio performance.

Overall, the investment allocation phase combines predictive, descriptive, and prescriptive analytics to identify the most suitable investment deployment strategy. By leveraging historical data, utilizing the Excel solver, and analyzing the outcomes, investors can make data-driven decisions that aim to maximize returns while managing risk effectively.

	Bonds	High tech stocks	Foreign stocks	Call options	Put options	Gold
Bonds	0.001	0.0003	-0.0003	0.00035	-0.00035	0.0004
High-tech stocks	0.0003	0.009	0.0004	0.0016	-0.0016	0.0006
Foreign stocks	-0.0003	0.0004	0.008	0.0015	-0.0055	-0.0007
Call options	0.00035	0.0016	0.0015	0.012	-0.0005	0.0008
Put options	-0.00035	-0.0016	-0.0055	-0.0005	0.012	-0.0008
Gold	0.0004	0.0006	-0.0007	0.0008	-0.0008	0.005

Table 1.5 : The Covariance matrix of assets' returns

Asset type	Returns
Bonds	7%
High tech stocks	0.12
Foreign stocks	0.11
Call options	0.14
Put options	0.14
Gold	0.09

The table displayed above is a section extracted from Microsoft Excel, and the weights presented in the table were determined using the solver function within Excel. To gain a deeper understanding of the investment landscape and identify the most advantageous opportunities, a predictive analytics approach was utilized.

To assess the potential returns and make well-informed investment decisions, two important data tables were utilized. The first table, known as the expected return of investment data table, provides insights into the projected returns of each asset in the portfolio if invested by an investor. This data enables a thorough evaluation of individual asset performance and their contribution to the overall portfolio return.

The second table employed in the analysis is the covariance matrix return table. This table examines the relationship between the returns of different assets and their covariance. Understanding covariance helps in assessing the level of diversification or correlation among the assets, which is crucial for managing risk and optimizing portfolio performance.

By incorporating these data tables and leveraging predictive analytics, the analysis aims to determine the most effective investment strategy that aligns with the desired returns and appropriate asset allocation. The term "resolutions" refers to the specific objectives or criteria that need to be fulfilled when identifying the optimal investment strategy. These resolutions are presented in the context of achieving desired returns and exploring the best investment opportunities.

Through this comprehensive analysis, utilizing predictive analytics along with the expected return of investment data table and the covariance matrix return table, investors can make informed decisions regarding asset selection and portfolio weighting. By considering these resolutions and leveraging the available information, investors can develop a robust investment strategy that maximizes the potential for desired returns and capitalizes on the best investment possibilities.

By utilizing extrapolative analytics, the results of each investment option within the portfolio can be predicted. In order to forecast the average returns for different types of assets, a reliance on models was emphasized. Moreover, factual modeling was employed to address questions such as how to allocate resources strategically to meet a minimum benchmark return of 11 percent while leveraging the insights gained from descriptive analytics models.

To further analyze the profitability of the investment, a combination of descriptive, predictive, and prescriptive approaches was employed. Prescriptive analytics played a vital role in providing recommendations for the optimal course of action, aiming to maximize the return on investment while meeting the distribution requirements for each portfolio.

The process involved conducting predictive and descriptive analyses using Microsoft Excel. Based on these analyses and considering the 11 percent projected return, the investment allocation was determined. The objective was to allocate the resources in a manner that would generate the desired returns and align with the overall investment strategy.

Through a careful examination of the available data and the application of prescriptive analytics, the analysis sought to identify the most effective plan of action. This plan aimed to optimize the return on investment while considering the specific requirements and constraints of the portfolio. By leveraging the insights from descriptive and predictive analytics, informed decisions were made regarding the allocation of resources and the overall investment strategy.

	Weights	Investment_allocation
Bonds	0.189807292	$ 1,898.07
High-tech stocks	0.108630255	$ 1,086.30
Foreign stocks	0.270827739	$ 2,708.28
Call options	0.047942564	$ 479.43
Put options	0.254469971	$ 2,544.70
Gold	0.128322811	$ 1,283.23

The solver tool generated important insights about the portfolio's performance. It revealed that the expected return of the portfolio was 0.11, indicating an anticipated return of 11%. This serves as a benchmark for assessing the investment's profitability.

The solver also calculated the portfolio's variance, which measures the level of risk associated with the portfolio. The computed variance value was 0.000736, representing the dispersion of returns among the portfolio's assets. A lower variance implies a more stable and predictable performance.

The weights of the assets in the portfolio were automatically determined by the solver, representing the proportion of the portfolio allocated to each asset. The solver's optimization process ensures that the weights are chosen to maximize the portfolio's return while considering the risk.

To evaluate the portfolio's risk, the standard deviation was calculated by taking the square root of the variance. The computed standard deviation was 0.027122579, providing a measure of the portfolio's volatility. A lower standard deviation indicates a more stable investment.

All these calculations and their respective results are summarized in the table, providing a comprehensive overview of the portfolio's expected return, variance, weights, and standard deviation. These metrics are essential in evaluating the portfolio's performance and risk, enabling investors to make well-informed decisions regarding their investment strategy and asset allocation.

portfolio_return	0.11
portfolio_variance	*0.000735634*
portfolio_Standard D	0.027122579

Furthermore, predictive analytics played a crucial role in addressing the identified challenges by identifying lucrative business opportunities and estimating the average rate of return. This involved analyzing segments that showed variations in asset performance and examining the relationships between different sets of assets based on their covariance.

Descriptive analytics, on the other hand, utilized the data available in the regular profits from speculation table to gain insights into the historical performance of the assets. This data served as a valuable source for evaluating the assets and understanding their behavior. Additionally, anticipated evaluations were incorporated to make predictions and forecasts.

The patterns and trends observed in the data provided valuable information that was utilized in both the rigorous analytical approach and decision-making processes. These patterns helped uncover the relationships and dependencies among the assets, offering a comprehensive understanding of their performance and behavior.

By combining predictive and descriptive analytics, a comprehensive analysis of the investment landscape was conducted. Historical data, anticipated evaluations, and observed patterns were leveraged to make informed decisions that aimed to optimize returns and identify favorable investment opportunities. The utilization of both analytical approaches allowed for a thorough examination of the available data and facilitated the formulation of strategies aligned with the investment objectives.

PART-2 Conclusion

The conclusion highlights the results of the analysis conducted on the relationship between the typical return figures (r) and the predicted outcomes (e) for the investment portfolio. Sequential values ranging from 10% to 15% were used to generate the predicted outcomes. The data displayed a mixture of positive and negative values, suggesting a reasonable fit of the straight model to the data.

Residuals, representing the differences between the predicted and actual outcomes, were computed for each data point. These residuals were then plotted in a diagram to assess the goodness of fit of the model. Despite the random pattern observed in the diagram, the straight model was found to adequately capture the overall relationship between the typical return figures and the predicted outcomes.

Based on the analysis and projections, specific asset allocation recommendations were provided to achieve a baseline return of 11% while minimizing risk. The recommended allocation includes specific amounts to be invested in high-tech stocks, bonds, foreign stocks, put options, gold, and call options, totaling $10,000 in the investment portfolio.

In summary, the conclusion summarizes the findings of the analysis, confirms the reasonable fit of the model to the data, and suggests a recommended asset allocation strategy based on the desired return and risk objectives.

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