NATIONAL AVIATION UNIVERSITY
FACULTY OF TRANSPORT, MANAGEMENT AND LOGISTICS
LOGISTICS DEPARTMENT

Methodological recommendations for preparing students for laboratory classes

on the subject «ELECTRONIC LOGISTICS »

Educational degree: «Bachelor»
Educational Professional Program: "Logistics"
Field of study: 07 "Management and Administration"
Specialty: 073 "Management"

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Discussed and approved by the Logistics Department
Minutes № ____ of ____. ____. 202___

Head of the Department
_____ Viacheslav MATVIEIEV

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 1. Opportunities of the electronic environment for logistics

Laboratory Class #1

Aim:

- apply MS Excel tools to optimize the accounting of goods at the trading company.

Know:

- basic definitions and terms in electronic logistics;
- the development stages of e-logistics;
- types of logistics marketplaces;
- difference between Internet and Intranet;
- MS Excel tools to optimize the accounting of goods at the trading company.

Be able:

- optimize the accounting of goods at the trading company.

Task:

It is necessary to automate the choice of the good for sale, the cost of purchasing and the calculation of the cost of sale in excel's table named sales. source data are in Excel's table named purchases (fig #1.1), which consists information about date, quantity and unit cost of goods purchase.

	A	B	C	D
1	PURCHASES			
2	DATE	NAME OF GOODS	QUANTITY, UNIT	UNIT COST OF GOODS PURCHASE, GRN.
3	01 September 2017	notebook Asus VivoBook Max X541SA	4	6600
4	01 September 2017	notebook Prestigio Smartbook 116A03	3	3500
5	01 September 2017	keyboard Aula Dragon Deep USB Black	5	700
6	01 September 2017	mouse Esperanza Titanum TM116E Wireles	10	100
7	01 September 2017	notebook HP 255 G5	2	7200
8	02 September 2017	notebook Dell Inspiron 3552	2	6600
9	02 September 2017	notebook Acer Extensa EX2519-C4XE	4	6300
10	02 September 2017	notebook HP 250 G5 (W4M56EA) Black	3	6110
11	02 September 2017	mouse Sven RX-515 Silent USB Black	12	110
12	02 September 2017	mouse A4Tech N-310-3 USB Blue	15	180
13	03 September 2017	keyboard Logitech K400 Wireless Touch Key	4	1000
14	03 September 2017	tablet Genius MousePen i608X	2	1600
15	03 September 2017	tablet Genius EasyPen i405X	3	1200
16				

Figure #1.1 – Filling the data in table «purchases»

To create new table named SALES (figure #1.2)

F	G	H	I	J
SALES				
DATE	NAME OF GOODS	SOLD, UNIT	UNIT COST OF GOODS PURCHASE, GRN.	SELLING PRICE OF GOODS

Figure #2 – Creating the table «SALES»

Step #2. Filling the data in table «SALES» (column «Name of goods»).

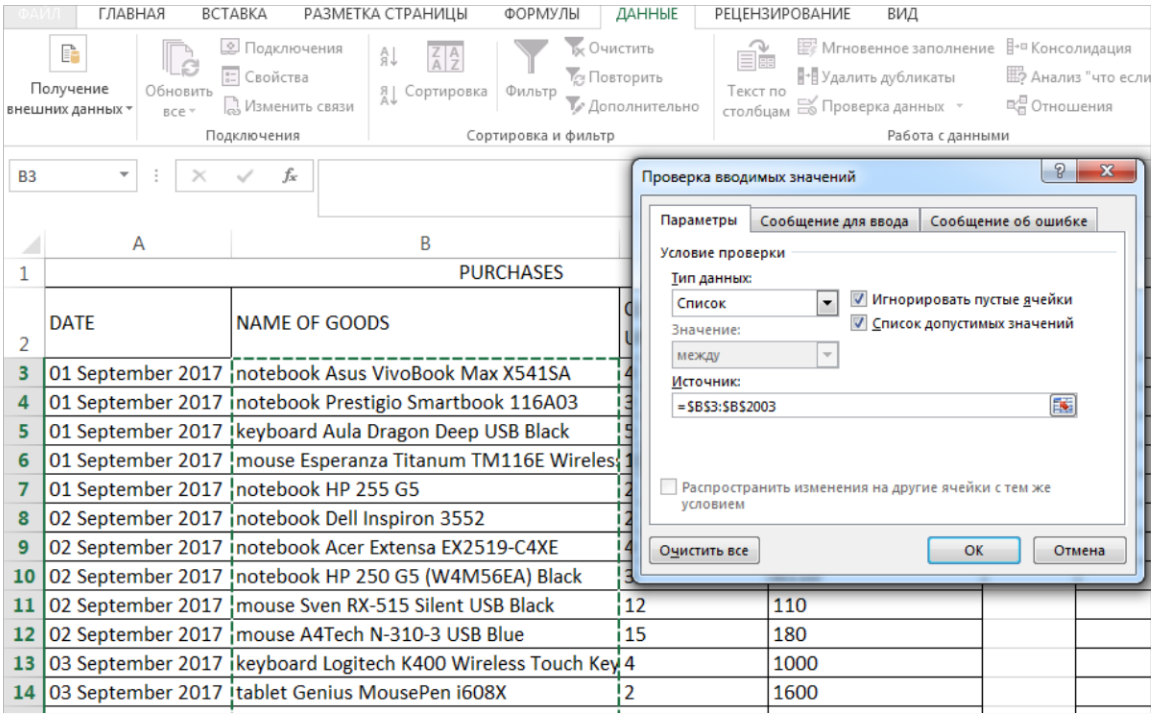
2.1. Select empty cells in column «Name of goods», for example a cell range (G3:G2003).

2.2.1 for MS Office 2003: open file tab «Data/Дані», then find «Validation /Перевірка»

2.2.2 for MS Office 2007 and other new versions: open file tab «Data/Дані», then click «Data validation /Перевірка даних»

2.3. On the Settings/Параметри tab, in the Allow box / Тип даних, select List / Список.

2.4. In the Source box / Джерело select, a cell range (B3:B2003) in column «Name of goods» of table PURCHASES, for example like you can see on figure 1.3.



	A	B	C	D
1		PURCHASES		
2	DATE	NAME OF GOODS		
3	01 September 2017	notebook Asus VivoBook Max X541SA		
4	01 September 2017	notebook Prestigio Smartbook 116A03		
5	01 September 2017	keyboard Aula Dragon Deep USB Black		
6	01 September 2017	mouse Esperanza Titanum TM116E Wireles		
7	01 September 2017	notebook HP 255 G5		
8	02 September 2017	notebook Dell Inspiron 3552		
9	02 September 2017	notebook Acer Extensa EX2519-C4XE		
10	02 September 2017	notebook HP 250 G5 (W4M56EA) Black		
11	02 September 2017	mouse Sven RX-515 Silent USB Black	12	110
12	02 September 2017	mouse A4Tech N-310-3 USB Blue	15	180
13	03 September 2017	keyboard Logitech K400 Wireless Touch Key	4	1000
14	03 September 2017	tablet Genius MousePen i608X	2	1600

Figure #1.3 – Filling the data in table «SALES» (column «Name of goods»)

After this action you can find the list of goods that you entered in table Purchases. So this simplifying your work with entering name of goods in table Sales.

Step #3. Filling the data in table «SALES» (column «Unit cost of goods purchase»).

3.1. Function VLOOKUP / ВПР is a function to lookup up and retrieve data in a table. The «V» in VLOOKUP stands for vertical, which means the data in the table must be arranged vertically, with data in rows). To use VLOOKUP, you supply 4 pieces of information, or «arguments»:

The value you are looking for (lookup_value). The range of cells that make up the table (table_array). The number of the column from which to retrieve a result (column_index). The match mode (range_lookup, TRUE = approximate (1), FALSE = exact (0)).

3.1. So in cell I3 enter =ВПР($G$3:$G$2003;$B$3:$D$2003;3;0) (look fig. #1.4).

	B	C	D	E	F	G	H	I
1	PURCHASES				SALES			
2	NAME OF GOODS	QUANTITY, UNIT	UNIT COST OF GOODS PURCHASE, GRN.		DATE	NAME OF GOODS	SOLD, UNIT	UNIT COST OF GOODS PURCHASE, GRN.
3	notebook Asus VivoBook Max X541SA	4	6600		02.09.2017	mouse Esperanza Titanum TM	2	=ВПР($G$3:$G$2003;$B$3
4	notebook Prestigio Smartbook 116A03	3	3500			notebook HP 255 (	ВПР(искомое_значение; таблица; номер_столбца; [интервальный	
5	keyboard Aula Dragon Deep USB Black	5	700					
6	mouse Esperanza Titanum TM116E Wireless	10	100					
7	notebook HP 255 G5	2	7200					
8	notebook Dell Inspiron 3552	2	6600					
9	notebook Acer Extensa EX2519-C4XE	4	6300					
10	notebook HP 250 G5 (W4M56EA) Black	3	6110					
11	mouse Sven RX-515 Silent USB Black	12	110					
12	mouse A4Tech N-310-3 USB Blue	15	180					
13	keyboard Logitech K400 Wireless Touch Keyboard	4	1000					
14	tablet Genius MousePen i608X	2	1600					
15	tablet Genius EasyPen i405X	3	1200					

Figure #1.4 – Using function «VLOOKUP / ВПР » (column « Unit cost of goods purchase »)

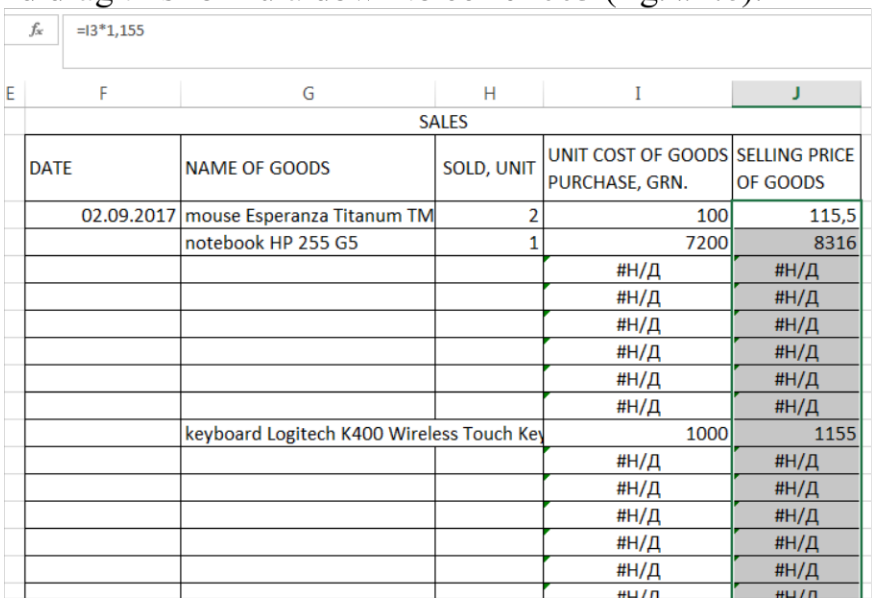
3.2. Click and drag this formula from cell I3 to the other cells in this column, which you can find down, for example to cell I2003 (fig. #1.5).

E	F	G	H	I
	SALES			
	DATE	NAME OF GOODS	SOLD, UNIT	UNIT COST OF GOODS PURCHASE, GRN.
	02.09.2017	mouse Esperanza Titanum TM	2	100
		notebook HP 255 G5	1	7200
				#Н/Д
				#Н/Д

Figure #1.5 – How to drag function «VLOOKUP / ВПР» (column «Unit cost of goods purchase»)

Step #4. Filling the data in table «SALES» (column «Selling price of goods»).

4.1. Then you write the formula of price with mark-up in cell J3 like = I3*H3*1,155 and drag this formula down to cell J2003 (fig. #1.6).



E	F	G	H	I	J
	SALES				
	DATE	NAME OF GOODS	SOLD, UNIT	UNIT COST OF GOODS PURCHASE, GRN.	SELLING PRICE OF GOODS
	02.09.2017	mouse Esperanza Titanum TM	2	100	115,5
		notebook HP 255 G5	1	7200	8316
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
		keyboard Logitech K400 Wireless Touch Ke		1000	1155
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д
				#Н/Д	#Н/Д

Figure #1.6 – How to enter and drag function the formula of price with mark-up (column « Selling price of goods»)

MODULE 1 “LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS”

Topic 1. Opportunities of the electronic environment for logistics

Laboratory Class #2

Aim:

- apply MS Excel tools to optimize the analysis process

Know:

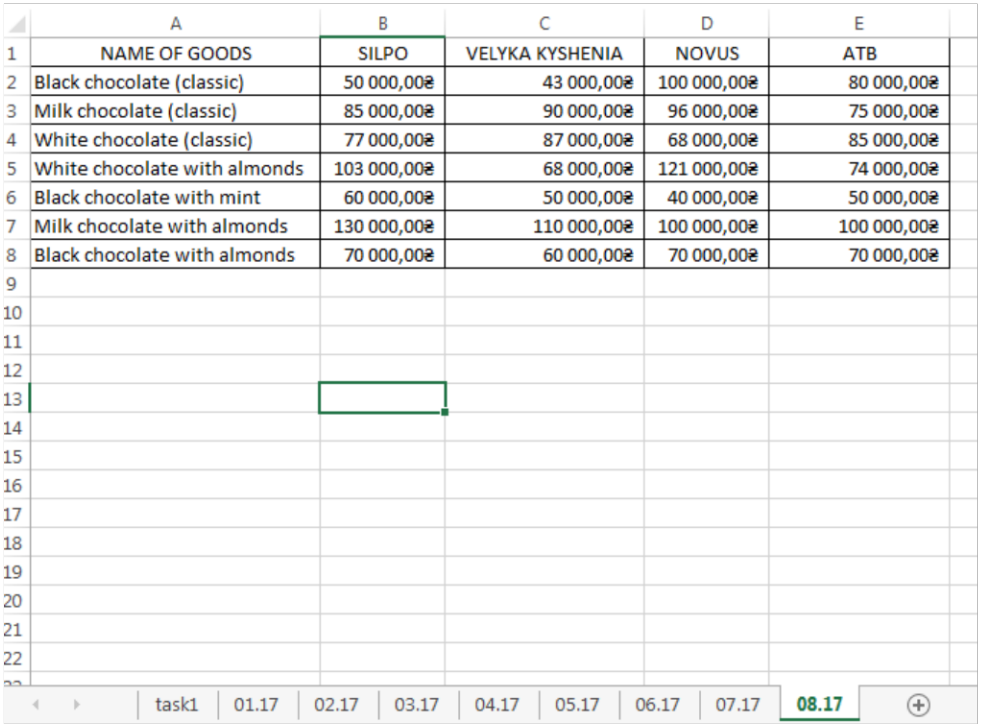
- types of information e-resource;
- types of electronic information flow;
- main legal aspects of e-logistics;
- role of cloud technologies in logistics.

Be able to:

- optimize the analysis process.

Task:

It is necessary to create consolidated table of sales from different Excel sheets, where you can find volumes of different product sales from different months. So, you have statistics materials about sales of chocolate in different network of supermarkets within eight months this year (fig. 2.1).



	A	B	C	D	E
1	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
2	Black chocolate (classic)	50 000,00₴	43 000,00₴	100 000,00₴	80 000,00₴
3	Milk chocolate (classic)	85 000,00₴	90 000,00₴	96 000,00₴	75 000,00₴
4	White chocolate (classic)	77 000,00₴	87 000,00₴	68 000,00₴	85 000,00₴
5	White chocolate with almonds	103 000,00₴	68 000,00₴	121 000,00₴	74 000,00₴
6	Black chocolate with mint	60 000,00₴	50 000,00₴	40 000,00₴	50 000,00₴
7	Milk chocolate with almonds	130 000,00₴	110 000,00₴	100 000,00₴	100 000,00₴
8	Black chocolate with almonds	70 000,00₴	60 000,00₴	70 000,00₴	70 000,00₴

task1 | 01.17 | 02.17 | 03.17 | 04.17 | 05.17 | 06.17 | 07.17 | 08.17

Figure #2.1 – Source data according to statistics

Step #1. You have to create new table for summarizing of statistics results (fig. #2.2).

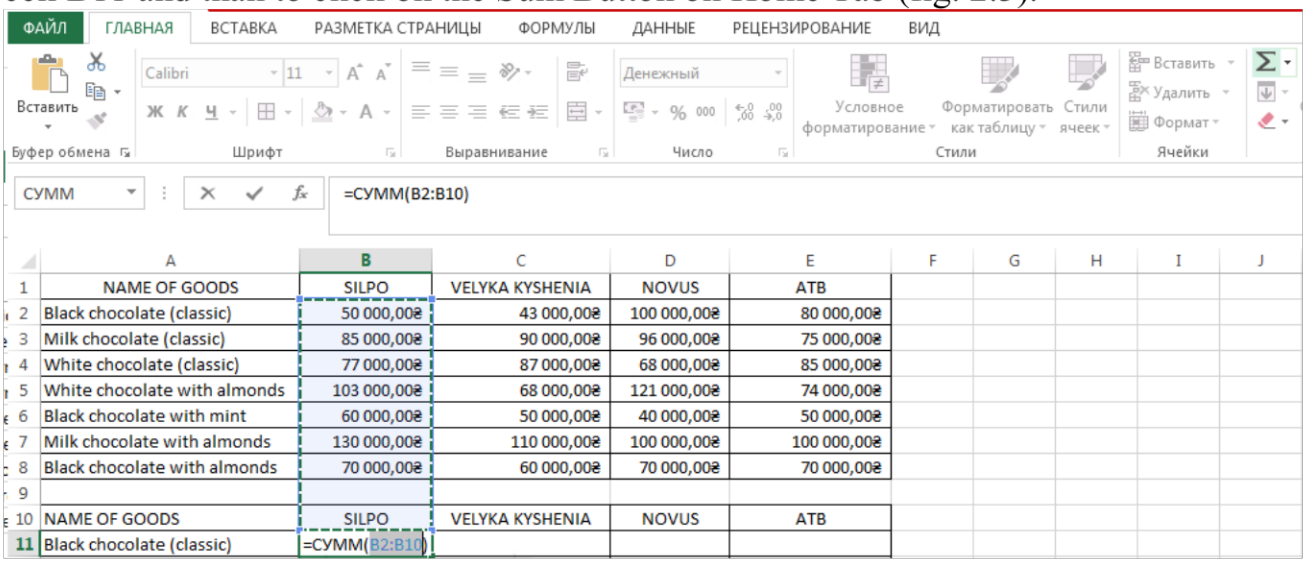
	A	B	C	D	E
1	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
2	Black chocolate (classic)	50 000,00₴	43 000,00₴	100 000,00₴	80 000,00₴
3	Milk chocolate (classic)	85 000,00₴	90 000,00₴	96 000,00₴	75 000,00₴
4	White chocolate (classic)	77 000,00₴	87 000,00₴	68 000,00₴	85 000,00₴
5	White chocolate with almonds	103 000,00₴	68 000,00₴	121 000,00₴	74 000,00₴
6	Black chocolate with mint	60 000,00₴	50 000,00₴	40 000,00₴	50 000,00₴
7	Milk chocolate with almonds	130 000,00₴	110 000,00₴	100 000,00₴	100 000,00₴
8	Black chocolate with almonds	70 000,00₴	60 000,00₴	70 000,00₴	70 000,00₴
9					
10	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
11	Black chocolate (classic)				
12	Milk chocolate (classic)				
13	White chocolate (classic)				
14	White chocolate with almonds				
15	Black chocolate with mint				
16	Milk chocolate with almonds				
17	Black chocolate with almonds				
18					
19					
20					
21					
22					

task1 | 01.17 | 02.17 | 03.17 | 04.17 | 05.17 | 06.17 | 07.17 | 08.17

Figure #2.2 – Source data according to statistics

Step #2.

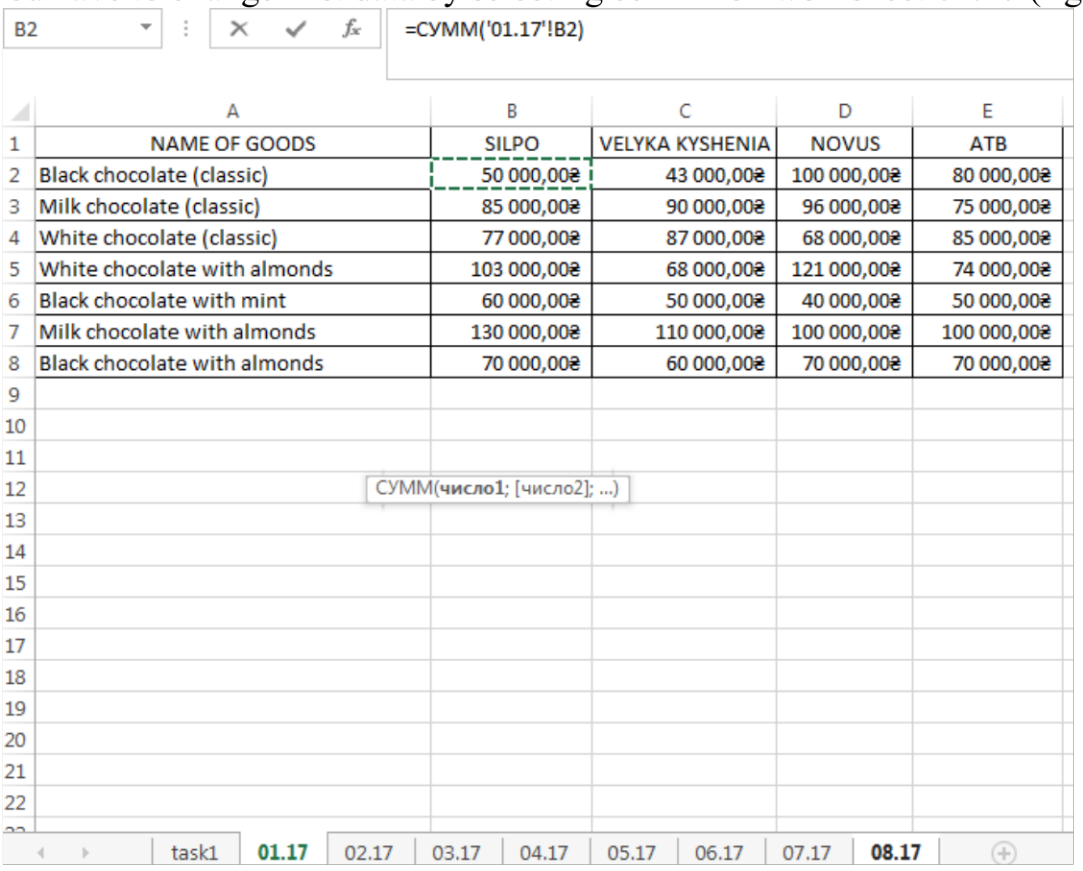
2.1. It is necessary to enter formula of sum in cell B11, for this you have to click on cell B11 and than to click on the Sum Button on Home Tab (fig. 2.3).



	A	B	C	D	E	F	G	H	I	J
1	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB					
2	Black chocolate (classic)	50 000,00₴	43 000,00₴	100 000,00₴	80 000,00₴					
3	Milk chocolate (classic)	85 000,00₴	90 000,00₴	96 000,00₴	75 000,00₴					
4	White chocolate (classic)	77 000,00₴	87 000,00₴	68 000,00₴	85 000,00₴					
5	White chocolate with almonds	103 000,00₴	68 000,00₴	121 000,00₴	74 000,00₴					
6	Black chocolate with mint	60 000,00₴	50 000,00₴	40 000,00₴	50 000,00₴					
7	Milk chocolate with almonds	130 000,00₴	110 000,00₴	100 000,00₴	100 000,00₴					
8	Black chocolate with almonds	70 000,00₴	60 000,00₴	70 000,00₴	70 000,00₴					
9										
10	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB					
11	Black chocolate (classic)	=СУММ(B2:B10)								

Fig. 2.3

2.2. You have to change first data by selecting cell B2 on worksheet 01.17 (fig. 2.4)



	A	B	C	D	E
1	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
2	Black chocolate (classic)	50 000,00₴	43 000,00₴	100 000,00₴	80 000,00₴
3	Milk chocolate (classic)	85 000,00₴	90 000,00₴	96 000,00₴	75 000,00₴
4	White chocolate (classic)	77 000,00₴	87 000,00₴	68 000,00₴	85 000,00₴
5	White chocolate with almonds	103 000,00₴	68 000,00₴	121 000,00₴	74 000,00₴
6	Black chocolate with mint	60 000,00₴	50 000,00₴	40 000,00₴	50 000,00₴
7	Milk chocolate with almonds	130 000,00₴	110 000,00₴	100 000,00₴	100 000,00₴
8	Black chocolate with almonds	70 000,00₴	60 000,00₴	70 000,00₴	70 000,00₴
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

Fig. 2.4

2.3. You should press and hold out the **Shift** key and choose worksheet 08.17 and to press Enter key (fig. 2.5).

Step #3.

You have to press a cell B11 while move the mouse pointer down on cell range in rows (fig. 2.6) and then on cell range in column (fig. 2.7).

You can find the result of summarizing on fig. 2.8.

B11 =СУММ('01.17:08.17'!B2)

	A	B	C	D	E
1	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
2	Black chocolate (classic)	50 000,00₴	43 000,00₴	100 000,00₴	80 000,00₴
3	Milk chocolate (classic)	85 000,00₴	90 000,00₴	96 000,00₴	75 000,00₴
4	White chocolate (classic)	77 000,00₴	87 000,00₴	68 000,00₴	85 000,00₴
5	White chocolate with almonds	103 000,00₴	68 000,00₴	121 000,00₴	74 000,00₴
6	Black chocolate with mint	60 000,00₴	50 000,00₴	40 000,00₴	50 000,00₴
7	Milk chocolate with almonds	130 000,00₴	110 000,00₴	100 000,00₴	100 000,00₴
8	Black chocolate with almonds	70 000,00₴	60 000,00₴	70 000,00₴	70 000,00₴
9					
10	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
11	Black chocolate (classic)	400 000,00₴			

Fig. 2.5

10	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
11	Black chocolate (classic)	400 000,00₴			
12	Milk chocolate (classic)				
13	White chocolate (classic)				
14	White chocolate with almonds				
15	Black chocolate with mint				
16	Milk chocolate with almonds				
17	Black chocolate with almonds				

Fig. 2.6

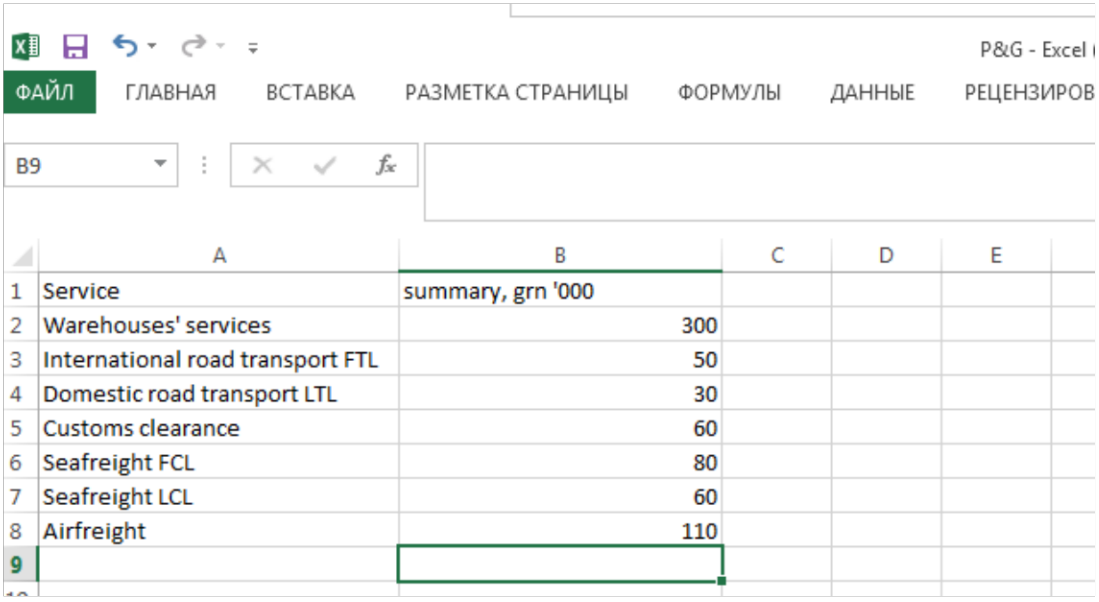
10	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
11	Black chocolate (classic)	400 000,00₴			
12	Milk chocolate (classic)	680 000,00₴			
13	White chocolate (classic)	616 000,00₴			
14	White chocolate with almonds	824 000,00₴			
15	Black chocolate with mint	480 000,00₴			
16	Milk chocolate with almonds	1 040 000,00₴			
17	Black chocolate with almonds	560 000,00₴			

Fig. 2.7

10	NAME OF GOODS	SILPO	VELYKA KYSHENIA	NOVUS	ATB
11	Black chocolate (classic)	400 000,00₴	344 000,00₴	800 000,00₴	640 000,00₴
12	Milk chocolate (classic)	680 000,00₴	720 000,00₴	768 000,00₴	600 000,00₴
13	White chocolate (classic)	616 000,00₴	696 000,00₴	544 000,00₴	680 000,00₴
14	White chocolate with almonds	824 000,00₴	544 000,00₴	968 000,00₴	592 000,00₴
15	Black chocolate with mint	480 000,00₴	400 000,00₴	320 000,00₴	400 000,00₴
16	Milk chocolate with almonds	1 040 000,00₴	880 000,00₴	800 000,00₴	800 000,00₴
17	Black chocolate with almonds	560 000,00₴	480 000,00₴	560 000,00₴	560 000,00₴

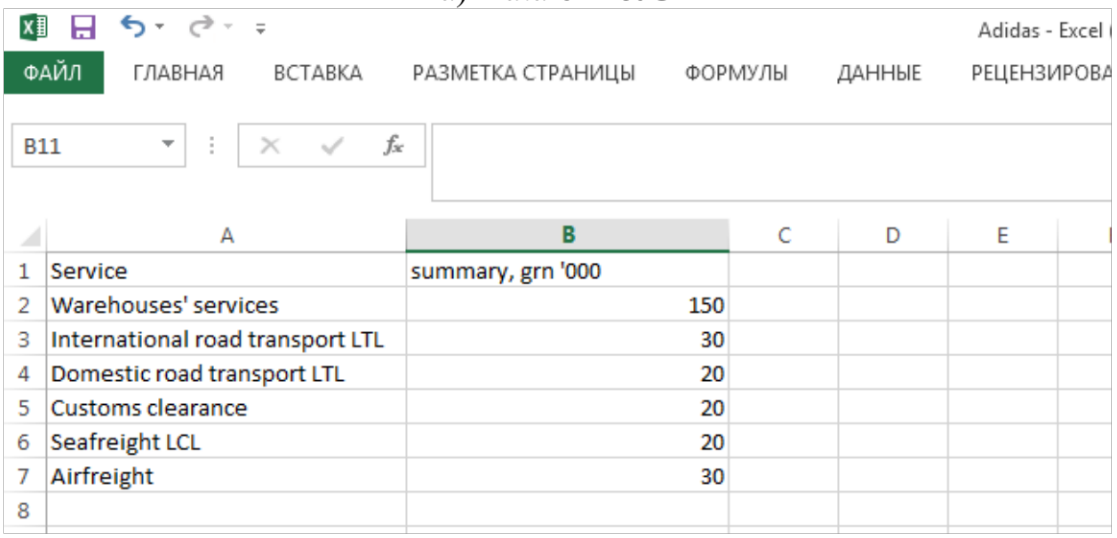
Fig. 2.8

TASK 2. It is necessary to make a consolidated sales report for the key customers of logistics provider's . There are various employees who collaborate with key clients and have their separate reports in separate Excel files with the services provided to the relevant key customer: Adidas, P&G, Unilever. An example is shown in tables (fig. 2.1).



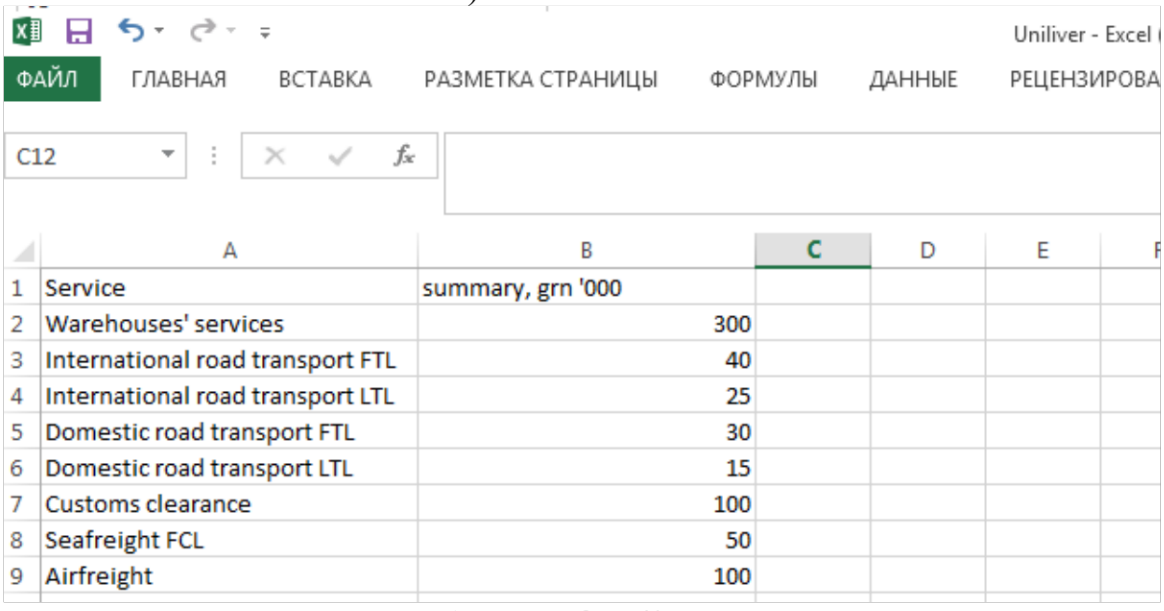
	A	B	C	D	E
1	Service	summary, grn '000			
2	Warehouses' services	300			
3	International road transport FTL	50			
4	Domestic road transport LTL	30			
5	Customs clearance	60			
6	Seafreight FCL	80			
7	Seafreight LCL	60			
8	Airfreight	110			
9					

a) Data of P&G



	A	B	C	D	E
1	Service	summary, grn '000			
2	Warehouses' services	150			
3	International road transport LTL	30			
4	Domestic road transport LTL	20			
5	Customs clearance	20			
6	Seafreight LCL	20			
7	Airfreight	30			
8					

b) Data of Adidas



	A	B	C	D	E
1	Service	summary, grn '000			
2	Warehouses' services	300			
3	International road transport FTL	40			
4	International road transport LTL	25			
5	Domestic road transport FTL	30			
6	Domestic road transport LTL	15			
7	Customs clearance	100			
8	Seafreight FCL	50			
9	Airfreight	100			

c) Data of Unilever

Fig. 2.1

Step #1. Open these three workbooks and new workbook.
Step #2. Click Consolidation on the tab Data on this new workbook. In the Function box, click the summary function because we want Excel to use to consolidate the data (SUM) like on fig. 2.2.

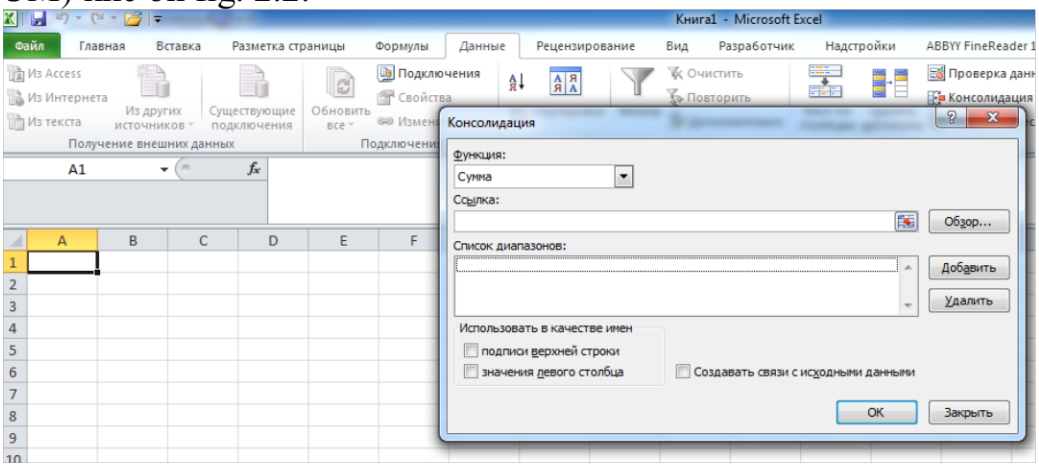


Fig. 2.1

Step #2. Select your data on file named «P&G.xls» into Link and Add button (fig. 2.2)

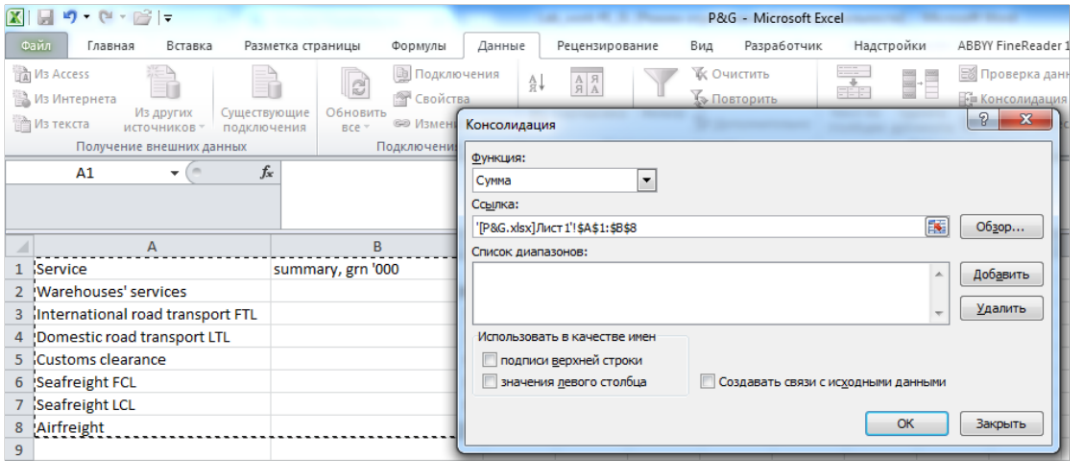


Fig. 2.2

Repeat last step with other file «Adidas.xls» and «Unilever.xls» (Fig.2.3) and

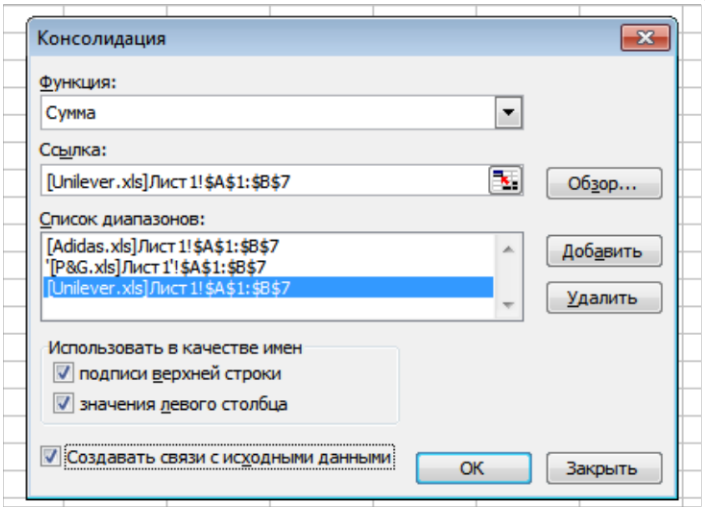


Fig. 2.3

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 2. Business models in electronic logistics

Laboratory Class #3

Aim:

- to design supply chain and understand logistics process for business model B2B and B2C.

Know:

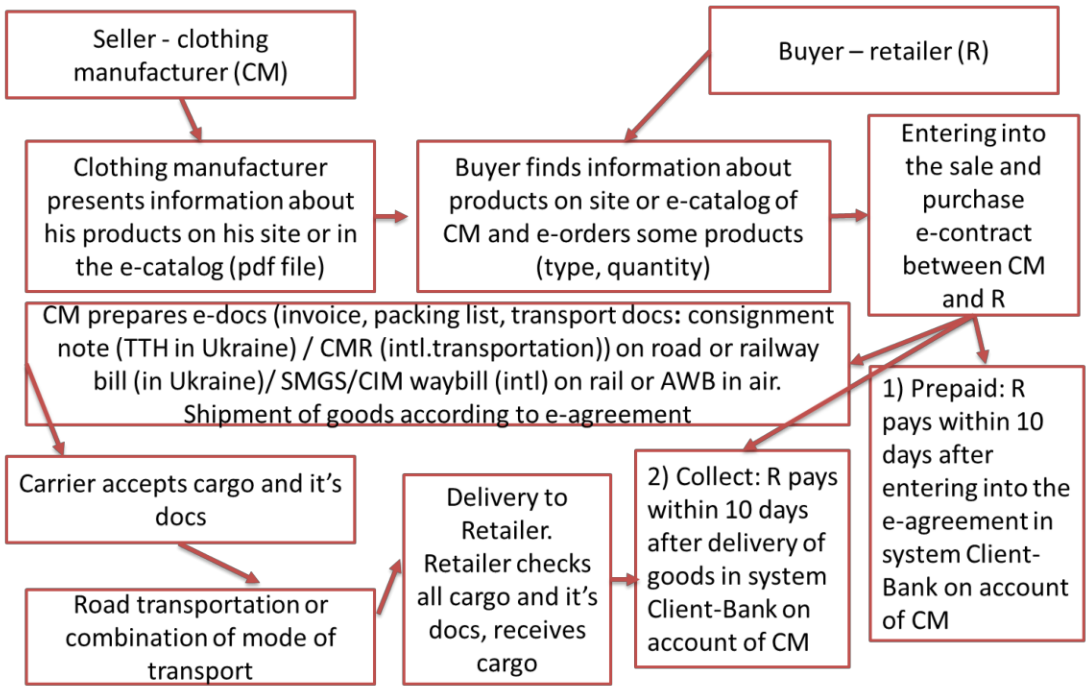
- definition of "B2B";
- definition of "B2C";
- logistics processes for business model B2B and B2C.

Be able to:

- design the supply chain of goods using for business model B2B and B2C.

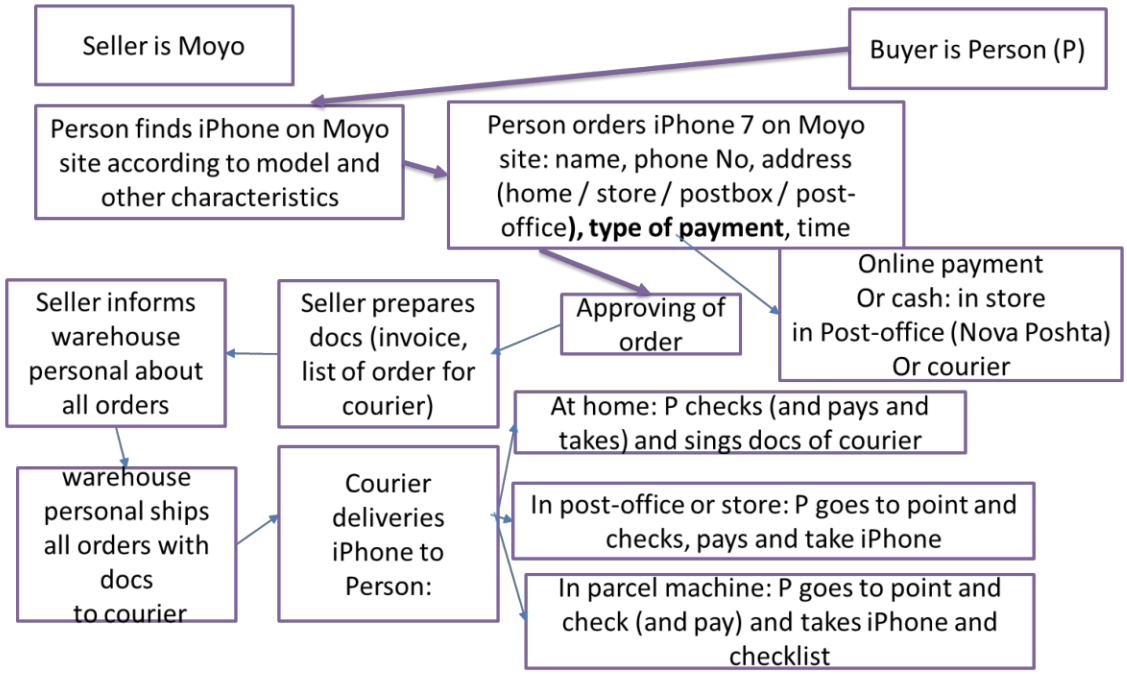
Task 1

Schematically describe interaction via the Internet B2B business model, the main figure - manufacturer of clothing. Identify according to the model: who is the buyer and who is the seller and how should the sales be organized, taking into account the principles of logistics both in the document flow and in the delivery of the goods.



Task 2

Schematically describe the interaction via the Internet on the business model B2C, the main figure is the internet-store MoYO. Identify according to the model: who is the buyer and who is the seller and how should the sales be organized, taking into account the principles of logistics both in the document flow and in the delivery of the goods.



MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 2. Business models in electronic logistics

Laboratory Class #4

Aim:

- to design supply chain and understand logistics process for business model C2B and C2C.

Know:

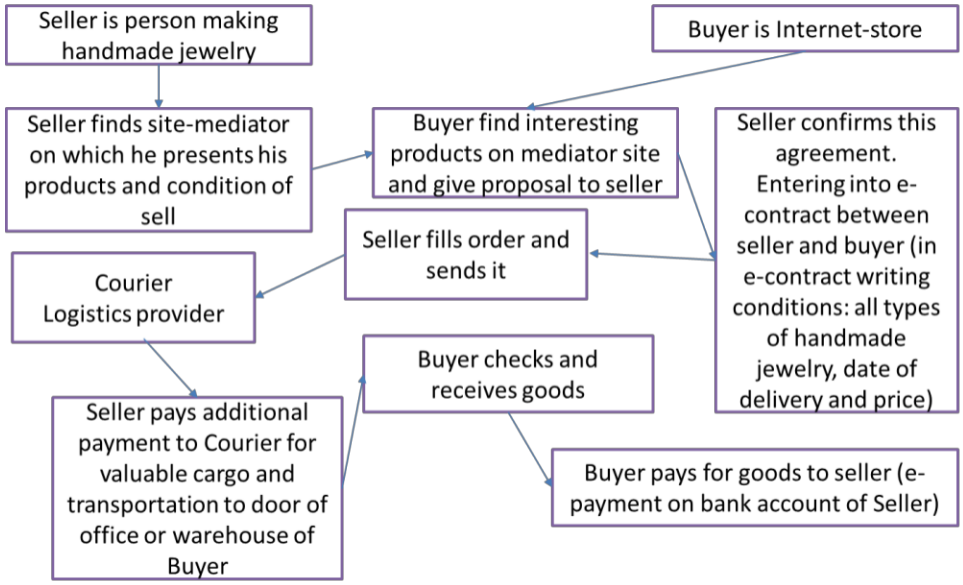
- definition of "C2B";
- definition of "C2C";
- logistics processes for business model C2B and C2C.

Be able to:

- design the supply chain of goods using for business model C2B and C2C.

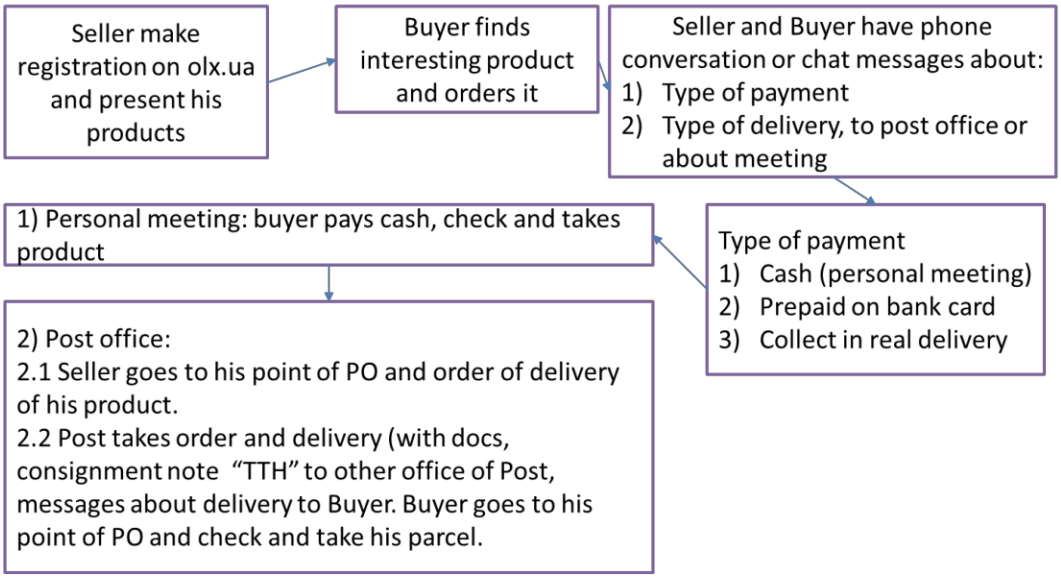
Task 1

Schematically describe the interaction via the Internet on the business model of C2B, the main figure is a Individual person making handmade jewellery. Identify according to the model: who is the buyer and who is the seller and how should the sales be organized, taking into account the principles of logistics both in the document flow and in the delivery of the goods.



Task 2

Schematically describe the interaction via the Internet on the business model of C2C, the main figure is customer #1, product – clothing. Identify according to the model: who is the buyer and who is the seller and how should the sales be organized, taking into account the principles of logistics both in the document flow and in the delivery of the goods.



MODULE 1 “LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS”

Topic 3. Mobile Internet and WAP technologies in logistics. E-procurement

Laboratory Class #5

Aim:

- to gain knowledge and skills in mobile internet applications.

Know:

- stage of development of Mobile Internet and WAP technologies in logistics;
- modern mobile internet applications;
- technologies for Mobile communications and monitoring systems.

Be able to:

- use mobile internet applications;
- calculate and compare cost of logistics in classic and mobile information process organization.

Task: BUSINESS GAME "MANAGEMENT OF BUSINESS PROCESSES IN SUPPLY CHAIN"

This game is planned for products that have a seasonal nature of demand, for example: beer or ice cream.

1. Basic provisions of the "production - distribution" system.

1.1. Definition of four teams: Retailer, Wholesaler, Distributor and Factory. Each team consists of one or two people (in the case of two people: one is engaged in purchasing products (in the case of the plant team - production planning), the second - sales / deliveries to customers).

1.2. All roles are identical (the exception is the factory). Everyone has a stock of products. After receiving an order, everyone makes deliveries according to the "factory → distributor → wholesaler → retailer" chain. Everyone can place an order according to the "retailer → wholesaler → distributor → factory" chain. Order processing and delivery is carried out every week. Products are received a week after the order (for the factory - a week after the start of production).

2. Basic rules.

2.1. Each team records expenses in the expense accounting table (Table 1), which also includes the role assigned to a group of players - the team.

2.2. The goal of the game is to minimize the total costs of each team. The team with the lowest total costs at the end of the game is the winner. Inventory costs are 0.5 hryvnias. per unit per week. Unfulfilled orders (orders that arrived but were not fulfilled because there was no stock) are valued at UAH 1.0. per unit per week. Each team's expenses are tallied by week and added up at the end of the game to determine total expenses.

2.3. Communications between teams. Each team must be given 52 order cards, as the game is designed for 52 weeks.

2.3.1. THE FIRST GAME. Communication is carried out only between teams through: order transfer and order receipt on cards (sheets of paper - table 2 and table 3). Players hand over orders for production and delivery on sheets of paper upside down so that others cannot see the size of the order.

2.3.2. THE SECOND GAME. Communication between teams is carried out not only through: order transfer and order receipt on cards (sheets of paper - table 2 and table 3). It is allowed to view the amount of stocks of teams in the chain.

3. Stages of the game.

3.1. The game leader (teacher) announces the stages of the game according to the game process. During the first few stages of the game, when the system is still in equilibrium, the game director should slowly announce the next stage in order for the players to understand the mechanics of the game. For this, it is desirable that the manager informs that each retailer will have a demand for one unit of the product during the first five weeks. Thus, the balance in the system will be maintained.

3.2. Determination of product demand in the retail network.

3.2.1. THE FIRST GAME. The leader of the game (the teacher) makes a forecast of the demand of the retail network for 52 weeks and writes this forecast on the board.

3.2.2. THE SECOND GAME. The game manager (teacher) makes a 52-week retail chain demand forecast and edits according to the actual demand and inventory of each team.

3.3. Each participant must have a stock of products in the amount of 1 unit of pallets of each type. Production of products is at least 1 unit of pallets, products can be ordered in the amount of at least 1 unit every week. The production time regardless of the volume is 1 week, the delivery time from the factory to the distributor, from the distributor to the wholesaler and from the wholesaler to the retailer is 1 week. Given that the game is designed for 52 weeks, players must understand that they must have a minimum amount of stock left at the end of the game.

4. Each game lasts at least an hour and a half, in the event that the game director maintains a good tempo of the game. "Flight analysis" of each game can take from 30 minutes.

Table 1. Registration form for each team.

Name of team

week	order to supplier	inventory	sales	fact volume of inventory at week end
1				
2				
3				
4				
5				
…				
52				

inventory X0,5+ Shortage =

Table 2. Product order card

Week:	
From:	
To:	
Quantity of order:	

Table 3. Product delivery card

Week:	
From:	
To:	
Quantity of suplly:	

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 3. Mobile Internet and WAP technologies in logistics. E-procurement

Laboratory Class #6

Aim:

- to gain knowledge and skills to prepare documentation for participation in e-tendering.
- to gain knowledge and skills to find optimal plan of e-procurement.

Know:

- methods of search for suppliers via the Internet;
- types of e-catalogs;
- definition and aim of e-procurement.
- e-documentation for participation in e-tendering;
- procedure for conducting e-tenders;
- components of e-contract.

Be able to:

- prepare documentation for participation in e-tendering;
- use e-logistics tender sites;
- find optimal plan of e-procurement

Task1:

Choose e-tender on e-logistics tender sites and prepare documentation for participation in e-tendering.

Task 2:

Find optimal costs of distribution system according to the next data which are presented in tables below.

Table 1 – Demand of DC, pallets

DC	B1	B2	B3	B4	B5	B6
DC 1	30	30	20	30	30	30
DC 2	30	20	30	45	30	20
DC 3	30	30	25	35	30	30

Table 2 – FG's demand percentage, which can be interchanged on other kind of product, %

DC	B1 on B4	B2 on B3	B3 on B2	B4 on B1	B5 on B6	B6 on B5
DC 1	30	30	20	30	30	30
DC 2	30	20	30	45	30	20
DC 3	30	30	25	35	30	30

Table 3 – The distances between points, km

To/from	Factory 1 (B1, B5)	Factory 2 (B2, B6)	Factory 3 (B4)	Factory 4 (B3)
DC 1	100	100	150	250
DC 2	200	200	150	250
DC 3	300	150	250	100

Table 4 – Transport cost of delivery, usd / pallet· km

To/from	Factory 1 (B1, B5)	Factory 2 (B2, B6)	Factory 3 (B4)	Factory 4 (B3)
DC 1	10	15	17	16
DC 2	20	22	19	10
DC 3	16	18	25	14

Producing capacity of each factory is 400 pallets per month.

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 4. Electronic systems for booking and sale transportation

Laboratory Class #7

Aim:

- to gain knowledge and skills to apply electronic systems for booking and sale transportation.

Know:

- modern booking systems for air, rail, sea and road passenger transportation;
- modern booking systems for air, rail, sea and road cargo transportation.

Be able to:

- apply electronic systems for booking and sale transportation.

Task.

1. Choose the route of passenger and book passenger transportation applying modern booking systems

2. Choose the route of cargo and book cargo transportation applying modern booking systems

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 4. Electronic systems for booking and sale transportation

Laboratory Class #8

Aim:

- to gain knowledge and skills to apply electronic calculator of the cost of transportation

Know:

- modern electronic transport portals and their role in booking;
- definition and applying of e-freight.

Be able to:

- calculate the cost of transportation;
- applying electronic transport portals.

Task:

2. Choose the route of cargo and calculate the cost of transportation applying electronic transport portals.

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 5. Logistics of e-commerce and service in an electronic environment

Laboratory Class #9-10

Aim:

- to gain knowledge and skills to organization of logistics processes of e-commerce

Know:

- types of online store;
- types of delivery channels and supply chains in e-commerce;
- features of organization of reverse logistics processes for e-commerce.

Be able to:

– to design delivery channel and calculate the time of logistics processes in conditions of uncertainty

Task: “Delivery time modeling of goods, which were bought in an overseas Internet-store”

The aim of work is to systematize and deepen the students' knowledge of building a logistics chain “Internet store – buyer”.

The main task of individual work is to assess the time of implementation of the delivery of goods to the buyer of the Internet store.

The student should know:

- logistics processes for the organization and implementation of delivery of goods ordered by the customer in the Internet store;
- rules of planning and construction of the delivery chain of the goods purchased in the Internet store.

The student should be able to:

- plan e-goods delivery routes;
- use knowledge of constructing logistics operations in the logistics chain;
- develop optimal interaction of subjects in the delivery of goods purchased in the Internet store.

A logistics operator specializing in delivering goods from an overseas Internet stores wants to determine the time of arrival of the goods “to the door” of the buyer with a probability of 90-95%.

The main stages of organizing the good’s delivery from overseas Internet store was identified:

1. Executing an e-order in the warehouse (marking the parcel and drawing up accompanying documents, sorting the cargo in the direction “the warehouse – the departure airport”);
2. Transportation inland (loading into a car, transportation in the direction “the warehouse – the departure airport”);
3. Formalities in the departure airport (passage of customs and other formalities, registration on the cargo terminal, transfer of accompanying documents to the air carrier, loading in the aircraft);
4. International air transportation;
5. Formalities in the destination airport (cargo unloading from the aircraft, registration on the cargo terminal, passing customs and other formalities);
6. Delivery and processing of goods in the warehouse of a logistics operator in Ukraine (loading into a car, transportation to the warehouse, unloading in the warehouse, sorting by direction);
7. Delivery “to the door” of the buyer (transportation and hand over the goods to the buyer).

Variant of task from the table 1 is defined by your number in the list of group.

Table 1 – Delivery route (marking: K – Boryspil airport, L - Lviv Danylo Halytskyi) the arrival airport is chosen based on the shortest distance between the destination city and the arrival airport

Number in the list of group	City and airport of departure	Destination city	Time of departure (to the determine airport), in LT	Time of flight
1.	Vilnius	Konotop	14:30 (K) 20:20 (L)	1:30 (K) 1:20 (L)
2.	Amsterdam	Nizhyn	15:20 (K) 21:10 (L)	03:05 (K) 02:40 (L)
3.	Istanbul	Kovel	14:00 (K) 17:40 (L)	02:00 (K) 02:05 (L)
4.	Brussels	Lutsk	21:50 (K) 16:10 (L)	02:10 (K) 02:50 (L)
5.	Munich	Korosten	16:20 (K) 10:10 (L)	02:40 (K) 01:45 (L)
6.	Batumi	Korostyshiv	13:20 (K) 08:30 (L)	02:50 (K) 01:40 (L)
7.	Tel Aviv	Kryviy Rih	10:40 (K) 15:30 (L)	03:20 (K) 02:45 (L)
8.	Nice	Boyarka	17:10 (K) 16:00 (L)	03:15 (K) 02:20 (L)
9.	Vienna	Yuzhnoukrainsk	16:00 (K) 17:30 (L)	02:05 (K) 01:35 (L)
10.	Rome	Fastiv	13:20 (K) 18:10 (L)	02:55 (K) 02:00 (L)
11.	Frankfurt	Ternopil	07:00 (K) 10:50 (L)	02:55 (K) 01:45 (L)
12.	Naples	Kamyanets-Podilsky	22:50 (K) 21:00 (L)	03:15 (K) 02:25 (L)
13.	Thessaloniki	Khmelnytskyi	10:00 (K) 15:30 (L)	02:25 (K) 01:30 (L)
14.	Riga	Nova Kakhovka	14:10 (K) 21:20 (L)	01:55 (K) 02:15 (L)
15.	Athens	Uman	08:00 (K) 12:10 (L)	02:40 (K) 01:35 (L)
16.	Burgas	Bila Tserkva	11:00 (K) 15:10 (L)	02:10 (K) 01:15 (L)
17.	Larnaca	Pervomaysk	17:00 (K) 19:00 (L)	03:55 (K) 02:40 (L)
18.	Almaty	Voznesensk	09:00 (K) 08:00 (L)	05:50 (K) 06:35 (L)
19.	Zurich	Rivne	10:10 (K) 16:25 (L)	02:55 (K) 01:40 (L)
20.	Berlin	Chernihiv	13:00 (K) 15:20 (L)	02:10 (K) 01:15 (L)
21.	Oslo	Chernivtsi	18:00 (K)	02:55 (K)

			19:10 (L)	02:35 (L)
22.	Barcelona	Ivano-Frankivsk	17:00 (K) 21:30 (L)	03:45 (K) 02:55 (L)
23.	London	Berdychiv	16:25 (K) 18:45 (L)	03:10 (K) 02:25 (L)
24.	Madrid	Poltava	14:15 (K) 15:20 (L)	04:20 (K) 03:30 (L)
25.	Prague	Zhytomyr	22:20 (K) 12:35 (L)	01:30 (K) 00:45 (L)
26.	Paris	Dnipro	13:40 (K) 09:10 (L)	02:50 (K) 01:55 (L)
27.	Belgrade	Zaporizhzhia	15:40 (K) 20:25 (L)	02:30 (K) 01:35 (L)

Initial data of the logistic processes are determined by the students independently according to the data in Table 2 (a - the last digit of a student's record book).

Table 2 – Determination of initial data on the organization of good's delivery

№	Logistics process	Min time x_{min}, min.	Max. time x_{max}, min.	Average time, x_{av}, min.	Standard deviation of time, σ, min.
1.	Executing an e-order in the warehouse	5	15	7+a for a≤4, 4+a for a>4	For a < 6 (0,3+0,01*a)* x_{av} for a≥ 6 (0,25+0,01*a)* x_{av}
2.	Transportation inland	20	50	34+a	(0,4+0,01*a)* x_{av}
3.	Formalities in the departure airport	40	90	60-a	(0,2+0,01*a)* x_{av}
4.	International air transportation (the arrival airport is either Boryspil or Lviv, depending on the destination city!!!)	Based on the time taken in Table 1 (column 5). After that, the minimum and maximum limits are set like ∓ 7 min.		(x_{min} + x_{max})/2	(0,15+0,01*a)* x_{av}
5.	Formalities in the destination airport	25	45	30+a	(0,4+0,02*a)* x_{av}
6.	Delivery and processing of goods in the warehouse of a logistics operator in Ukraine	15	30	18+a	Для a < 4 (0,31+0,02*a)* x_{av} для a≥ 4 (0,21+0,02*a)* x_{av}

7.	Delivery “to the door” of the buyer Transportation within Ukraine on the route: The warehouse of the logistic operator (Boryspil or Lviv - depending on which city is closer to the destination!) - "buyer's door" (destination city)	The transport time is defined as the ratio of km to the speed (50 km / h). Then the boundaries are asked as min -10 minutes. max +50 minutes.	(x_{min} + x_{max})/2	(0,1+0,01*a)* x_{av}

Task: determine the time of arrival of the goods “to the door” of the buyer with a probability of 90-95%..

Table 3 The laws of the distribution of random non negative variables according to the coefficient of variation *

Boundaries of the coefficient of variation	The distribution laws of random variables
1	2
$\nu \le 0{,}3$	Normal Distribution
$0{,}3 < \nu < 0{,}4$	Gamma Distribution
$0{,}4 \le \nu < 1$	Weibull Distribution
$\nu = 1$	Exponential Distribution

* - the coefficient of variation is found as the ratio of standard deviation to average meaning ($\upsilon = \sigma / x_{av}$)

Table 4 – Formulas of random meanings modeling

The laws of the distribution and its parameters	Distribution density $f(x)$	Formula of calculation
Normal Distribution, $\bar{x}$, σ	$\frac{1}{\sigma\sqrt{2\pi}}\exp\left[-\frac{(x-\bar{x})^2}{2\sigma^2}\right]$	$x_i = \bar{x} + \sigma\xi_i$
Weibull Distribution, m, x_0	$\frac{mx^{m-1}}{x_0^m}\exp\left[\left(\frac{x}{x_0}\right)^m\right]$	$x_i = x_0\sqrt[m]{-\ln \xi_i}$
Exponential Distribution, λ	$\lambda e^{-\lambda x}$	$x_i = -\frac{\ln \xi_i}{\lambda}$
Gamma Distribution η- whole digit), λ	$\frac{\lambda^\eta}{r(\eta)}e^{-\lambda x}\times x^{\eta-1}$	$x_i = -\frac{1}{\lambda}\sum_{j-1}^{\eta}\ln(1-\xi_i)$

The distribution’s parameters of random variables are determined as follows: the parameters of the normal law are the average meaning and the standard deviation.

– for the Weibull distribution: 1) parameter x_0 is the ration of the average meaning to the coefficient b_m and 2) parameter m can be determined from the table 5.

– the parameter for the exponential distribution is the value, inverse to the mean value.

– parameters of the gamma distribution can be found by the formulas:

$$\lambda = \frac{\bar{x}}{\sigma^2} \quad \eta = \frac{(\bar{x})^2}{\sigma^2}$$

The number of random numbers should be taken 100.

Table 5 - Parameters of the Weibull distribution

The coefficient of variation	Parameter b_m	Parameter m
1,000	1,000	1,0
0,910	0,965	1,1
0,837	0,941	1,2
0,775	0,924	1,3
0,723	0,911	1,4
0,681	0,903	1,5
0,640	0,897	1,6
0,605	0,892	1,7
0,575	0,889	1,8
0,547	0,887	1,9
0,523	0,887	2,0
0,499	0,886	2,1
0,480	0,886	2,2
0,461	0,886	2,3
0,444	0,886	2,4
0,428	0,887	2,5

Modelling for each logistics process is carried out with the help of the package “Data Analysis” (If the Data Analysis command is not available, you need to load the Analysis ToolPak add-in program), namely “Random number generation”.
Determining the time of delivery “to the door” with a probability of 90-95% to make using the package “Data Analysis”, namely “Histogram”.

MODULE 1 “LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS”

Topic 6. Electronic document management. Electronic data interchange

Laboratory Class #11

Aim:

– to gain knowledge and skills to organization of logistics processes of e-commerce

Know:

– types of online store;
– types of delivery channels and supply chains in e-commerce;
– features of organization of reverse logistics processes for e-commerce.

Be able to:

– to design delivery channel and calculate the time of logistics processes in conditions of uncertainty

Task: OPTIMIZATION PROCESSES' PRODUCTIVITY

Optimization productivity of j process is calculated by formula

$$P_i = \left(\frac{\Delta T_j}{F_j - \Delta T_j} \right) x\,100$$

where F_i – time before optimization for j process, min

ΔT_i - economy of time, which calculate as time before optimization minus time after optimization for j process.

Calculated optimization productivity for each kind of processes and total optimization productivity. Data kind of processes and time are given in table.
Table. Kind of processes and time's characteristics

Table 1

№ п/п	Kind of processes	Time before optimization, min Fj	Economy of time, min ΔT	Optimization productivity of processes P_i (%)
1.	Input Information in internal information system	40	20	100
2.	Calculating	5	4	400
3.	Preparation and printing reports, invoices and other documentation	30	15	100
4.	Selection of data and Analysis	44	10	300

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 6. Electronic document management. Electronic data interchange

Laboratory Class #12

Aim:

- to gain knowledge and skills to calculate economic valuation of EDI project

Know:

- the role of GS1 in logistics, the applying of GS1 codes.
- global Data Synchronization Network.
- the main advantages of EDI.
- order of implementation of EDI.
- the applying of EDI standards in the organization of transportation, carrying out customs procedures, and monitoring cargo flows.

Be able to:

- calculate economic valuation of EDI project

Task: **The economic valuation of EDI project**

1. Calculation of increasing the Efficiency of Business Operation in the EDI implementation, P_j (%)

$$P_j = \frac{\Delta T_j}{F_j - \Delta T_j} \times 100\%,$$

ΔT_j – saving time for the business operation with index j, min

F_j – performance time to the business operation with index j before the EDI implementation, min.

Table 1 – Initial data for calculating the efficiency of EDI implementation

№	Business Operation	Business Operation Time after EDI, min., Fj	Save time, min., ΔT
1.	Entering information	40	20
2.	Carrying out calculations	5	4
3.	Preparation and printing of reports	30	15
4.	Data selection	44	10

Savings associated with improving staff efficiency from the introduction of EDI:

$$\Gamma_e = Z_{\text{перс}} \times \frac{P_\Sigma}{100\%}, \quad (1)$$

$Z_{\text{перс}}$- salary bill, UAH.

2. Calculation of economic valuation of EDI project

First of all, it is necessary to determine the initial conditions of cash outflow and cash inflow from this project.

Assume that the initial capital investment required for EDI implementation is UAH 1,000,000. Monthly costs to support the operation of EDI is 60,000 UAH. in the first year, UAH 61,000 / month - 2 years, UAH 62,000 / month - 3 years, UAH 63,000 / month - 4 years, UAH 64,000 / month - 5 years.

Time of implementation of EDI is 3 months before first economic effect.

Cash inflow (benefits) are calculated based on the fact that:

the required number of packages of paper will be reduced by 50 boxes per month, in a box 5 packages of paper, the cost of each 90 UAH.

the frequency of refilling cartridges will decrease by 1 unit, the cost of refilling is UAH 150 per cartridge, a total of printers is 11.

the savings of the salary bill (due to the absence of the need to expand the staff) will be determined by formula (1), the average salary is 15,000 UAH per month, and the total number of staff who will use EDI is 11 employees.

Net present value (NPV) is a method used to determine the current value of all future cash flows generated by a project, including the initial capital investment.

The formula for NPV:

$$NPV = \sum_{t=1}^{n} \frac{Д_t - B_t}{(1+i)^t} \qquad (2)$$

where $Д_t$, — cash inflow during a single period t;
B_t, — cash outflow during a single period t;
i — discount rate or return that could be earned in alternative;
n — total number of time period.

The required rate of return is used as the discount rate for future cash flows to account for the time value of money. A currency today is worth more than a currency tomorrow because a currency can be put to use earning a return. Therefore, when calculating the present value of future income, cash flows that will be earned in the future must be reduced to account for the delay.

Table 2 – Net present value if discount rate is 15%

Period, t	Cash inflow, Дt	Cash outflow, Bt	Net cash inflow –outflow, Дt-Bt	$1/(1+i)^t$	$\frac{(Дt-Bt)}{(1+i)^t}$
0	828820,6	1540000	-711179,41	1	-711179
1	1105094	732000	373094,118	0,86957	324430
2	1105094	744000	361094,118	0,75614	273039
3	1105094	756000	349094,118	0,65752	229535
4	1105094	768000	337094,118	0,57175	192735
				NPV=	308559

Therefore, since the net present value has a positive value, the project is economically feasible and can be implemented.

The next criterion for valuation the effectiveness of the project is the Internal Rate of Return - IRR.

The calculation of IRR is performed by the method of successive approximations of the value of NPV to zero at different discount rates. Calculations are made according to the formula:

$$IRR = A + \frac{a(B - A)}{(a - b)} \quad (3)$$

where A – discount rate when value of NPV is positive;
B – discount rate when value of NPV is negative;
a – value of positive NPV when discount rate is A;
b – value of negative NPV when discount rate is B.

To calculate IRR, we need to determine the discount rate at which the Net Present Value will be negative.

Table 3 – Net present value if discount rate is 45% (negative NPV)

Period, t	Cash inflow, Дt	Cash outflow, Bt	Net cash inflow – outflow, Дt-Bt	$1/(1+i)^t$	$\underline{(Дt-Bt)}$ $(1+i)^t$
0	828820,6	1540000	-711179,41	1	-711179
1	1105094	732000	373094,118	0,68966	257306
2	1105094	744000	361094,118	0,47562	171745
3	1105094	756000	349094,118	0,32802	114509
4	1105094	768000	337094,118	0,22622	76256,9
				NPV=	-91362

Accordingly, by formula (3) we determine the internal rate of return, which will show at what size of the discount rate such a project will pay for itself, ie will be break-even:

IRR= 38%

Based on the above calculations, we build a graph for determining the Internal Rate of Return (Fig. 1).

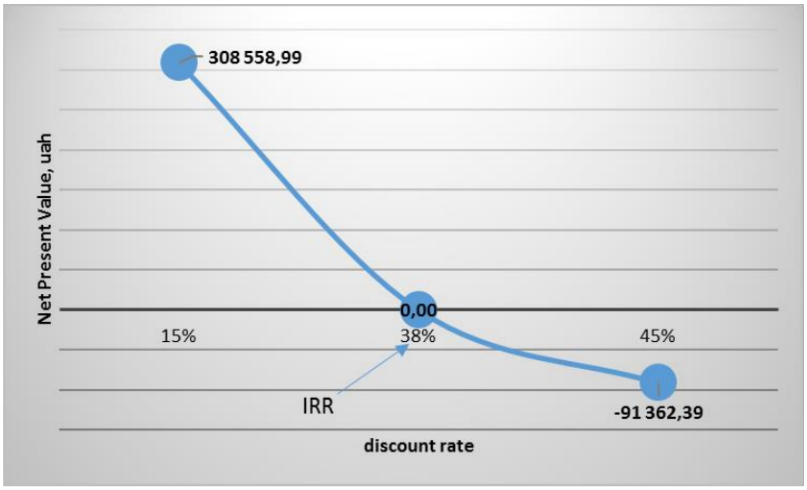


Figure 1 - Determination of the Internal Rate of Return

Calculate the payback period of the project by the formula:

$$T_{ok} = n + \frac{Ск}{Вч} \quad (4)$$

where n – quantity of periods preceding the time period in which the full refund of capital investment will take place;

Ск – capital investment, that remain refunded at the beginning of the time period in which they will be refunded in full;

Вч – cash inflow in the time period in which the full refund of capital investment will take place.

Table 4 – The payback period

Period, t	Cash inflow, Дt	Cash outflow, Bt	Дt-Bt with cumulative sum	
1	828820,6	1540000	-711179,41	
2	1105094	732000	-338085,29	
3	1105094	744000	23008,8235	Вч=$Д_3$-B_3 =361094
4	1105094	756000	372102,941	
5	1105094	768000	709197,059	

Thus, Tok is slightly more than two years (the first positive value of the difference between Cash inflow and Cash outflow). Let's define in more detail, for this we will take the last negative value of the difference - it will be Ск = -338085,29, Вч is calculated as the difference between Cash inflow and Cash outflow in the third year.

So, Ск/Вч = 0,9362, calculate in months: 0,9362*12=11,23, so 11 months.

Calculate the days: (11,23-11)*30 days = 7 days.

Thus, the EDI implementation project will payback in 2 years, 11 months and 7 days.

MODULE 1 “LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS”

Topic 7. Global standards of identification and their applying in the electronic environment

Laboratory Class #13

Aim:

- to gain knowledge and skills to fill in Logistics Label and calculate SSCC

Know:

- identification standards of GS1 like GTIN (Global Trade Item Number) and GLN (Global Location Number), SSCC (Serial Shipping Container

Code), Global Shipment Identification Number (GSIN) and Global Identification Number for Consignment (GINC) and others.

Be able to:

- fill in Logistics Label and calculate SSCC.

Task:
Fill in Logistics Label and calculate SSCC
Variant 1

Company name: _____
Product description: _____
Country:_____Ireland_____
SSCC USE BY
_____ 1.1.2024
GTIN
_____
LOT Prod date
824A2 1.12.2022

Variant 2

Company name: _____
Product description: _____
Country:_____Poland_____
SSCC
_____
GTIN Gross weight, kg
_____ 580.20
DUE DATE Count
1/12/2022 256

MODULE 1 “LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS”

Topic 7. Global standards of identification and their applying in the electronic environment

Laboratory Class #14

Aim:

- to gain knowledge and skills to fill in Logistics Label and calculate SSCC

Know:

- the role of GS1 in logistics, the applying of GS1 codes.
- global Data Synchronization Network.
- the main advantages of EDI.
- order of implementation of EDI.
- the applying of EDI standards in the organization of transportation, carrying out customs procedures, and monitoring cargo flows.

Be able to:

- analyse the efficiency of implementation of EDI.

TASK. Analyse the efficiency of implementation of EDI and advantages for companies.

1. CASE STUDIES OF COMARCH EDI URL: https://www.comarchedi.com/
   - Comarch EDI at Carrefour
   - Comarch EDI at Metro
   - Comarch EDI at Uniliver
   - Comarch EDI at BiC

2. CASE STUDIES OF EDI Basics URL: https:// https://www.edibasics.com/edi-resources/edi-case-studies/:

Nichirin U.K. Limited, NMBS, HCT Group, Dixons Carphone, DB Shenker and others.

3. CASE STUDIES OF B2BGATEWAY URL: https:// https://www.b2bgateway.net/case-studies//:

Franco Manufacturing, Neats, GT Brands, Evolve BioSystems and others.

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 8. Innovative technological trends in logistics

Laboratory Class #15

Aim:

- to gain knowledge and skills to calculate the forecast.

Know:

- specifics of forecast and their error;
- innovative technologies in Logistics;

Be able to:

- calculate the forecast.

Task. FORECAST IN LOGISTICS. HOLT-WINTERS METHOD

In the table 1 presents quarterly data on the volume of freight traffic for three years.

Table 1 Freight flow data

Year	Quarter	Period, t	Freight flow y_t, т
1	I	1	300
	II	2	320
	III	3	325
	IV	4	295
2	I	5	310
	II	6	325
	III	7	340
	IV	8	305
3	I	9	315
	II	10	335
	III	11	350
	IV	12	310

DESCRIPTION.

According to Table 1, let's build a graph on Fig. 1. It can be seen from the graph that the periodicity of seasonal fluctuations is 4, the trend has a linear dependence, there is a tendency to increase cargo flow.

Defining the slope of the trend line:

The trend line is determined by the formula: $y_t^{'} = a_0 + a_1 \cdot t$

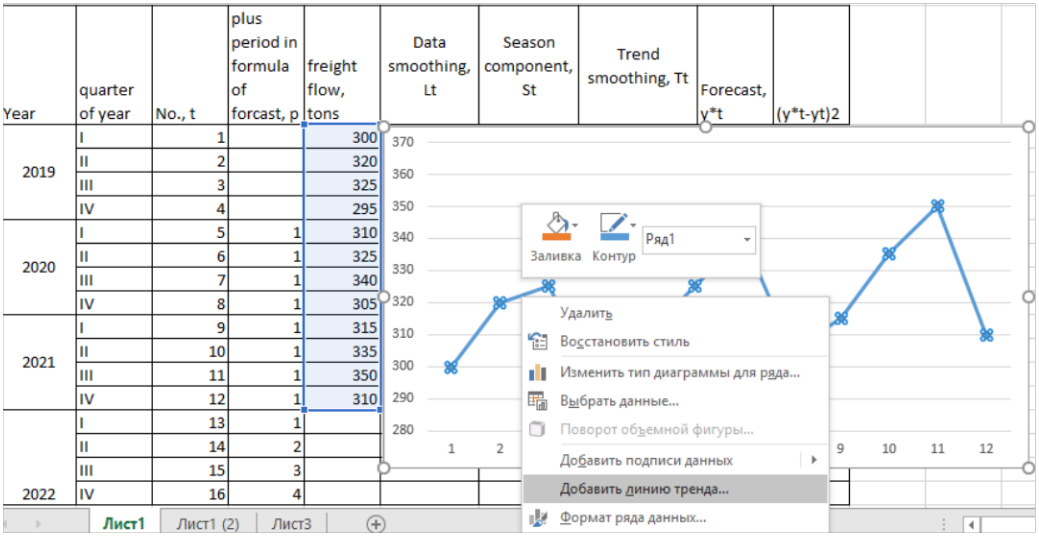


Fig. 1.1 Graph of freight flow data for three years and construction of a trend line

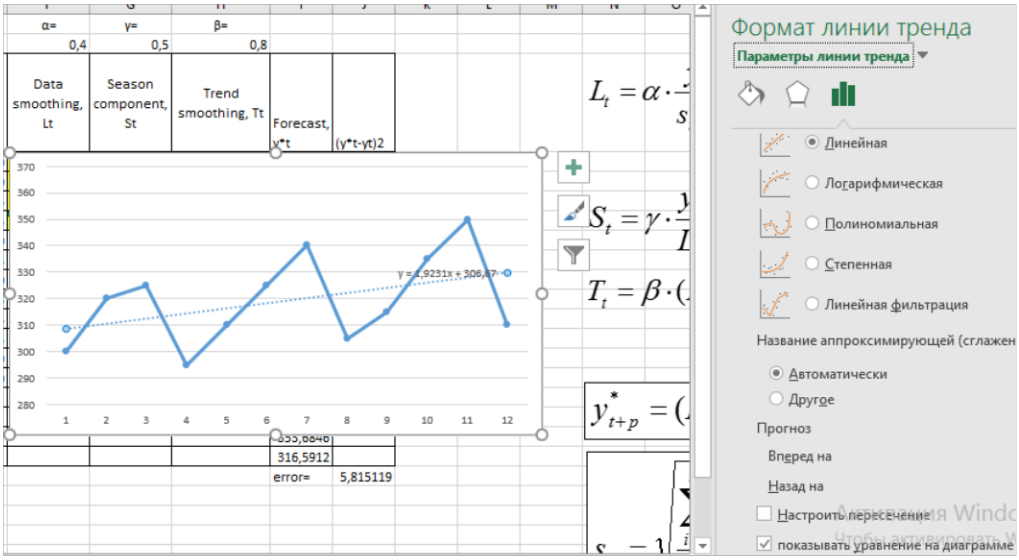


Fig. 1.2 Graph of freight flow data for three years and trend line

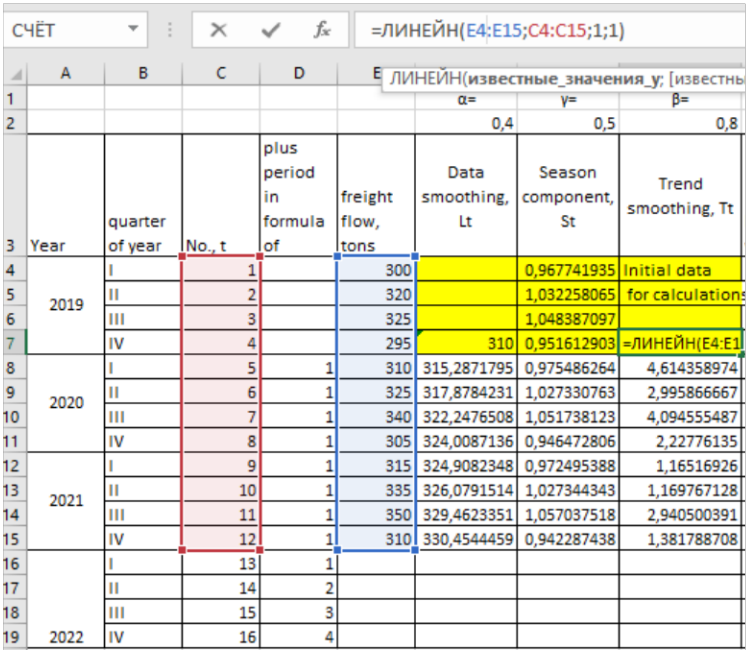
where

$$a_1 = \frac{N \cdot \sum y_i \cdot t_i - \sum y_i \cdot \sum t_i}{N \sum t_i^2 - \left(\sum t_i\right)^2}$$

$$a_0 = \frac{\sum y_i \cdot \sum t_i^2 - \sum t_i \cdot \sum y_i \cdot t_i}{N \cdot \sum t_i^2 - \left(\sum t_i\right)^2} \quad або \quad a_0 = \overline{y} - a_1 \cdot \overline{t}, \quad , \qquad (1)$$

$$де \ \overline{y} = \frac{1}{n}\sum_{i=1}^{n} y_i \ ma \ \overline{t} = \frac{1}{n}\sum_{i=1}^{n} t_i;$$

where the slope of the trend line determines a_1, this value can be calculated in MS Excel using LINEST function (in the variable " Known values y" we indicate the value of the freight flow for all periods from 1 to 12, in the variable " Known values x" we indicate the value of the period i.e. values from 1 to 12, enter the value "1" in the "Constant" and "Statistics" indicators; you can also use the MS Excel tab "Add a trend line" directly to the graph: $y_t^* = 306,67+1,9231t$ (2).



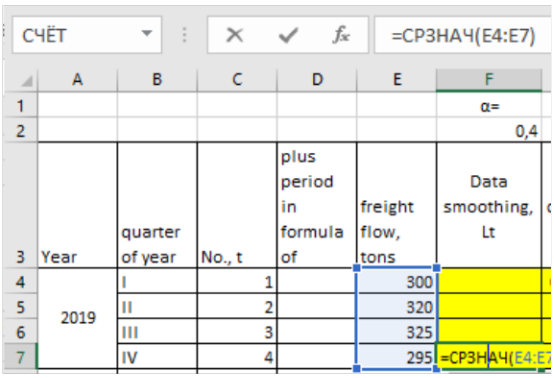
	A	B	C	D	E	F	G	H
1						α=	γ=	β=
2						0,4	0,5	0,8
3	Year	quarter of year	No., t	plus period in formula of	freight flow, tons	Data smoothing, Lt	Season component, St	Trend smoothing, Tt
4	2019	I	1		300		0,967741935	Initial data
5		II	2		320		1,032258065	for calculations
6		III	3		325		1,048387097	
7		IV	4		295	310	0,951612903	=ЛИНЕЙН(E4:E1
8	2020	I	5	1	310	315,2871795	0,975486264	4,614358974
9		II	6	1	325	317,8784231	1,027330763	2,995866667
10		III	7	1	340	322,2476508	1,051738123	4,094555487
11		IV	8	1	305	324,0087136	0,946472806	2,22776135
12	2021	I	9	1	315	324,9082348	0,972495388	1,16516926
13		II	10	1	335	326,0791514	1,027344343	1,169767128
14		III	11	1	350	329,4623351	1,057037518	2,940500391
15		IV	12	1	310	330,4544459	0,942287438	1,381788708
16	2022	I	13	1				
17		II	14	2				
18		III	15	3				
19		IV	16	4				

Fig. 2 – Using LINEST function

Therefore, the initial condition for trend smooting will be equal to the slope of the trend line, i.e. $a_1 = T_4$ =1,9231 (cell H7).

Estimation of the seasonal component of the additive model.

As the initial conditions for data smoothing, we will take as the average value of the freight flow, taking into account all the data of first year (Fig. 3).



	A	B	C	D	E	F
1						α=
2						0,4
3	Year	quarter of year	No., t	plus period in formula of	freight flow, tons	Data smoothing, Lt
4	2019	I	1		300	
5		II	2		320	
6		III	3		325	
7		IV	4		295	=СРЗНАЧ(E4:E7

Fig. 3 – Defining of the initial data smoothing

The initial data of season component are determined by the formula: $S_t = y_t / L_s$, where y_t - value of the freight flow for the period t=1, 2, 3, 4, L_s - the average value for the first year.

Accordingly: 300/310=0.968; 320/310=1.032; 325/310=1.048; =295/310=0.952 (Fig. 4).

Calculation of values of the seasonal component, data smoothing and trend smoothing.

After setting the initial data, it is necessary to determine the smoothing parameters, which can be chosen subjectively or from the condition of minimizing the forecast error. Let's take the initial smoothing parameters: α =0.4, β =0.8, γ =0.5.

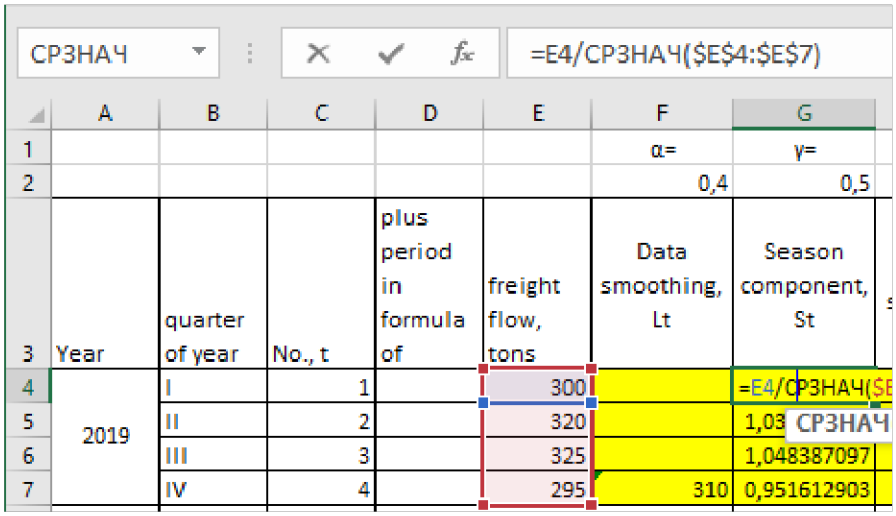


Fig. 4 – Determination of the initial data of the season component

For t=5 (the first quarter of the 2nd year), the actual value of the freight flow is 310 tons, the season component for the first quarter of the previous year is 0.968.

We determine by formula $L_t = \alpha \cdot \frac{y_t}{s_{t-s}} + (1-\alpha) \cdot (L_{t-1} + T_{t-1})$ (2)

values for data smoothing (Fig. 5):

$$L_5 = 0,4 \cdot \frac{310}{0,968} + (1-0,4) \cdot (310 + 1,923) = 315,287 \quad ,$$

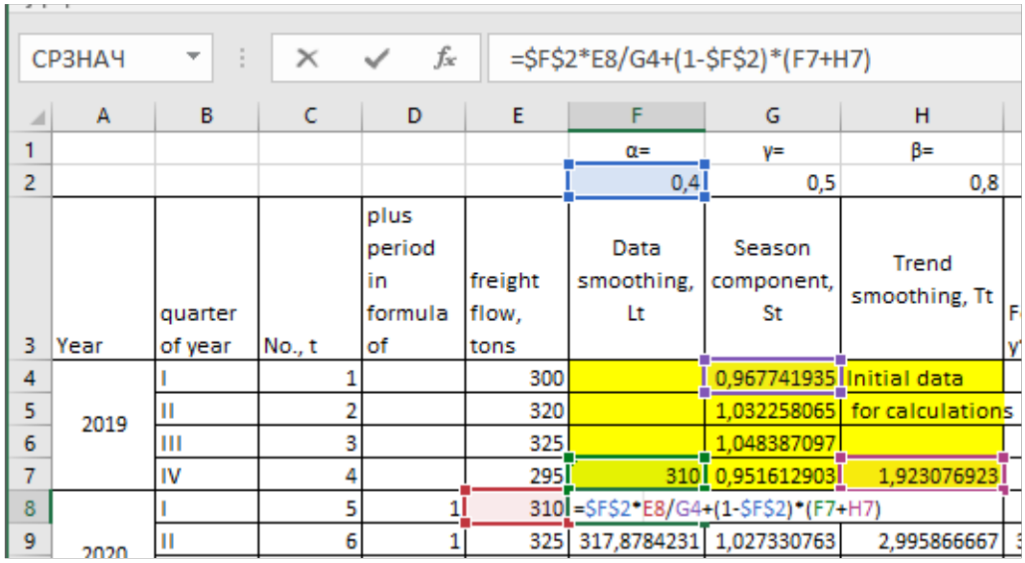


Fig. 5 – Calculation of the data smoothing value

The season component estimate is determined by the formula $S_t = \gamma \cdot \frac{y_t}{L_t} + (1-\gamma) \cdot S_{t-s}$

(3)

$S_5 = 0,5 \cdot \frac{310}{315,287} + (1-0,5) \cdot 0,968 = 0,975$ (fig.6).

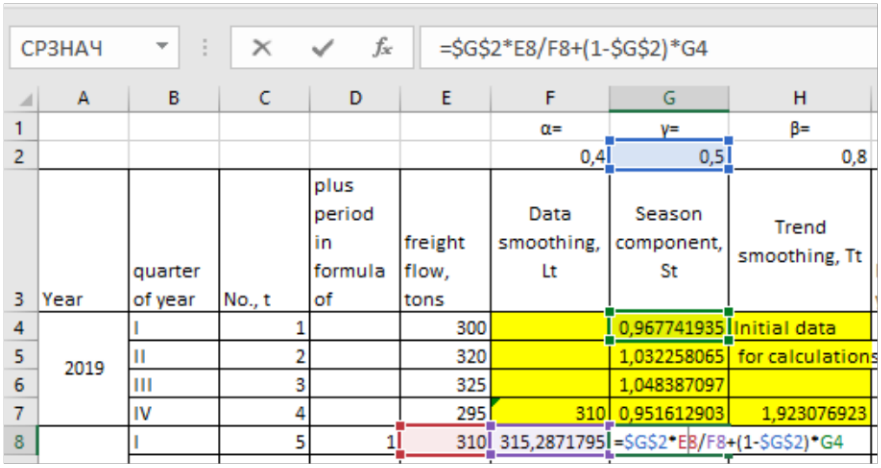


Fig.6 – Determining the value of season component

Trend smoothing is determined by the formula :

$$T_t = \beta \cdot (L_t - L_{t-1}) + (1-\beta) \cdot T_{t-1} \quad (4)$$

$T_5 = 0{,}8 \cdot (315{,}287 - 310) + (1-0{,}8) \cdot 1{,}923 = 4{,}614$ (Fig. 7).

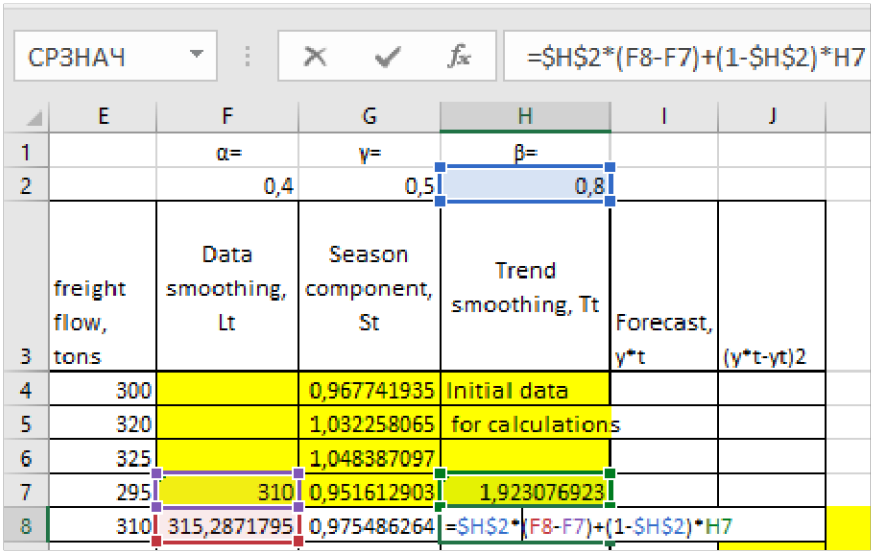


Fig. 7 – Determination of the trend smoothing value

Similarly, we perform calculations for t =6...12.

Making a forecast. Follow the formula $y^*_{t+p} = (L_t + p \cdot T_t) \cdot S_{t-s+p}$

As an example, let's make a forecast for the fifth period: $y^*_{4+1} = (310 + 1 \cdot 1{,}923) \cdot 0{,}967$ =301,861 tons.

We extend the completed calculations to row 15 (Fig. 8).

Separately, we will consider the procedure for calculating the forecast for the 4th year (Fig. 9):

for the first quarter: y*12+1 = (330.45+1·1.382)·0.971 ≈ 322.709 tons,

for the second quarter: y*12+2 = (330.45+2·1.382)·1.024 ≈ 342.329 tons,

for the third quarter: y*12+3 = (330.45+3·1.382)·1.06 ≈ 353.685 tons,

for the fourth quarter: y*12+4 = (330.45+4·1.382)·0.941 ≈ 316.591 tons.

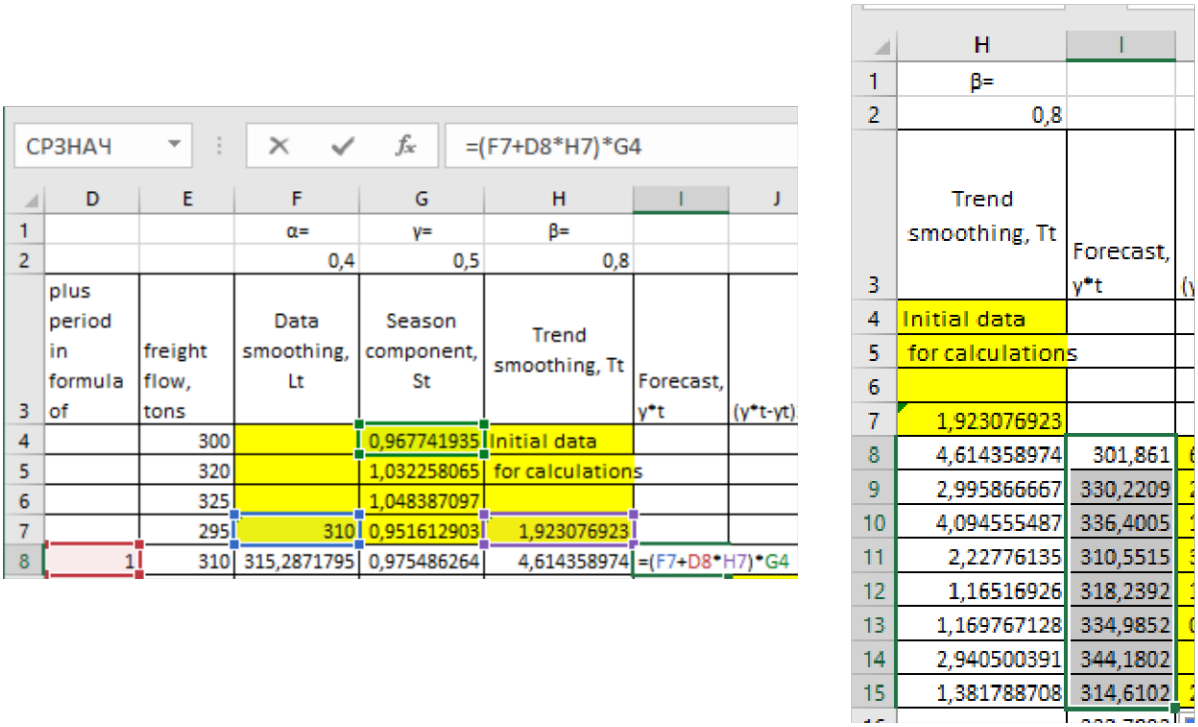


Fig. 8 – Calculation of forecast for fact data of freight flow

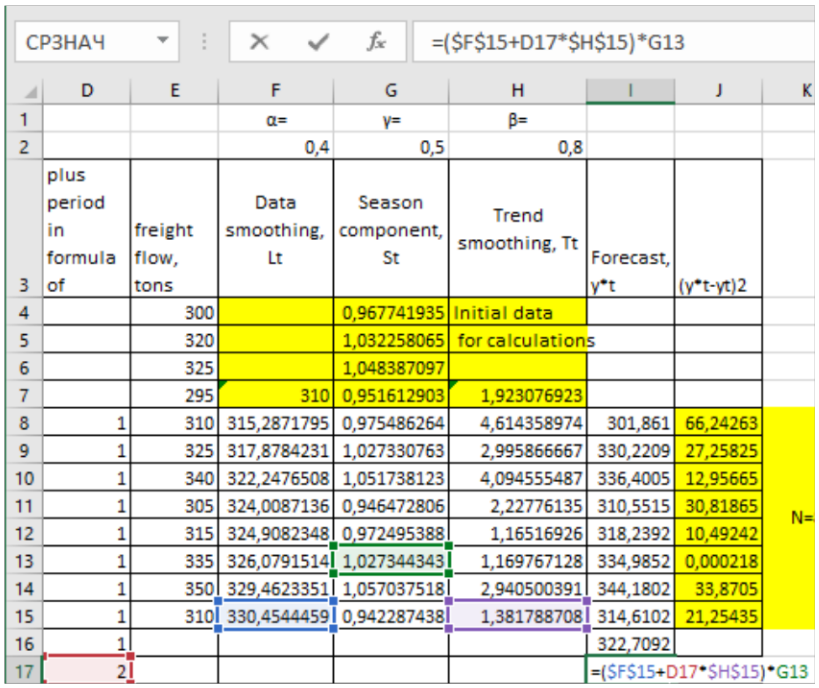
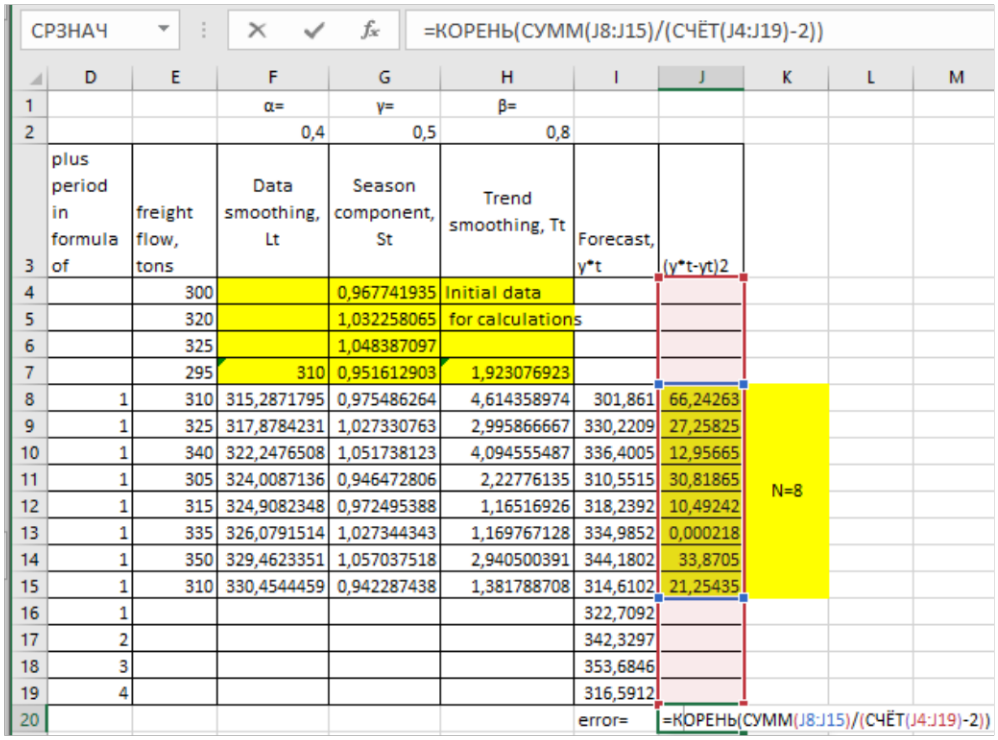


Fig. 9 – Calculation of forecast for future periods

Find the error of the model by formula $s_y = \sqrt{\dfrac{\sum_{i=1}^{N}(y_i^* - y_i)^2}{k}}$, (6)

where y_i^* - forecast values, y_i - fact values, $k = N - z$ - the number of degrees of freedom, which is determined depending on the number of observations $N =$ and the number of estimated parameters z (for a linear trend is equal to 2).

The calculation of the error is presented in fig. 10.



	D	E	F	G	H	I	J	K	L	M
1			α=	γ=	β=					
2			0,4	0,5	0,8					
3	plus period in formula of	freight flow, tons	Data smoothing, Lt	Season component, St	Trend smoothing, Tt	Forecast, y*t	(y*t-yt)2			
4		300		0,967741935	Initial data					
5		320		1,032258065	for calculations					
6		325		1,048387097						
7		295	310	0,951612903	1,923076923					
8	1	310	315,2871795	0,975486264	4,614358974	301,861	66,24263			
9	1	325	317,8784231	1,027330763	2,995866667	330,2209	27,25825			
10	1	340	322,2476508	1,051738123	4,094555487	336,4005	12,95665			
11	1	305	324,0087136	0,946472806	2,22776135	310,5515	30,81865	N=8		
12	1	315	324,9082348	0,972495388	1,16516926	318,2392	10,49242			
13	1	335	326,0791514	1,027344343	1,169767128	334,9852	0,000218			
14	1	350	329,4623351	1,057037518	2,940500391	344,1802	33,8705			
15	1	310	330,4544459	0,942287438	1,381788708	314,6102	21,25435			
16	1					322,7092				
17	2					342,3297				
18	3					353,6846				
19	4					316,5912				
20						error=	=КОРЕНЬ(СУММ(J8:J15)/(СЧЁТ(J4:J19)-2))			

Рис.10 – Визначення похибки прогнозу

In order to ensure the smallest error of the forecast model, it is necessary to choose the smoothing parameters as accurately as possible. To do this, we will use the MS Excel "Search for a solution", an example in Fig. 11.

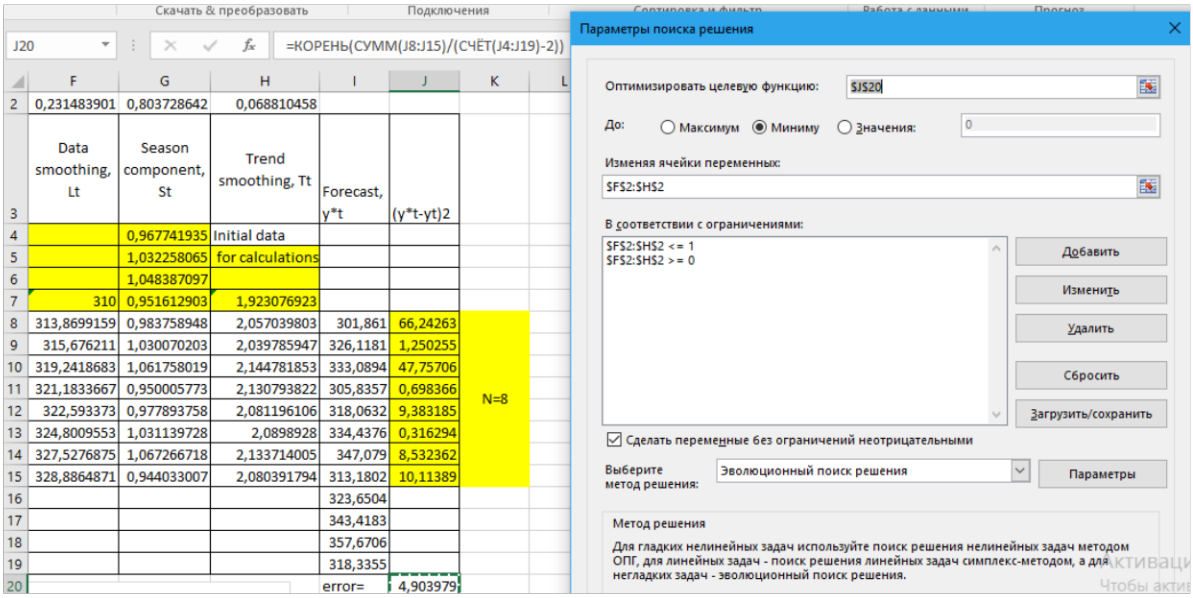


Fig.11 – MS Excel "Search for a solution" for determing α, β and γ

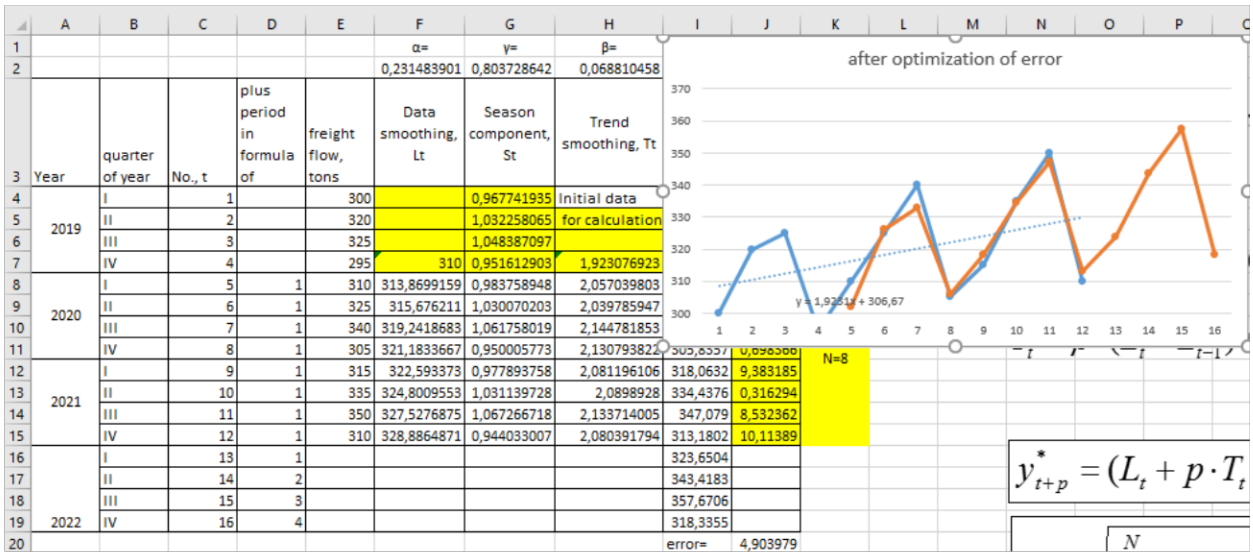
Stages of data entry in "Search for a solution":

Step 1: choose a cell from the forecast error calculation and set it as a target cell that should go to the smallest value.

Stage 2: in the "Changing cells" section, we install those cells that indicate values of α, β and γ .

Stage 3: in the "Restrictions" section, we set that values of α, β and γ, and must be at least 0 and no more than 1.

After finding the solution, we get the data shown on Fig. 12.



						α=	γ=	β=										
						0,231483901	0,803728642	0,068810458										
3	Year	quarter of year	No., t	plus period in formula of	freight flow, tons	Data smoothing, Lt	Season component, St	Trend smoothing, Tt										
4	2019	I	1		300		0,967741935	Initial data										
5		II	2		320		1,032258065	for calculation										
6		III	3		325		1,048387097											
7		IV	4		295	310	0,951612903	1,923076923										
8	2020	I	5	1	310	313,8699159	0,983758948	2,057039803										
9		II	6	1	325	315,676211	1,030070203	2,039785947										
10		III	7	1	340	319,2418683	1,061758019	2,144781853										
11		IV	8	1	305	321,1833667	0,950005773	2,130793822	305,8357	0,698366								
12	2021	I	9	1	315	322,593373	0,977893758	2,081196106	318,0632	9,383185								
13		II	10	1	335	324,8009553	1,031139728	2,0898928	334,4376	0,316294								
14		III	11	1	350	327,5276875	1,067266718	2,133714005	347,079	8,532362								
15		IV	12	1	310	328,8864871	0,944033007	2,080391794	313,1802	10,11389								
16	2022	I	13	1					323,6504									
17		II	14	2					343,4183									
18		III	15	3					357,6706									
19		IV	16	4					318,3355									
20									error=	4,903979								

Fig. 12 Adjusted forecast results

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Topic 9. Innovative technological trends in logistics

Laboratory Class #16

Aim:

– to gain knowledge and skills to operate with pivot-table and big-data.

Know:

– importance of big data analytics and the applying in logistics.

Be able to:

– to operate with pivot-table and big-data.

Task:

A pivot table allows you to extract the significance from a large, detailed data set.

The information of departure and arrival flights via airport "Boryspil" are presented in file Lab_2. The information of codes and name of airlines and the information of codes and name of airport are present in file Codes of Airlines and Airports.

You should solve the next task:

I. Create pivot table of information of monthly summary quantity of arrival passengers for each airline.

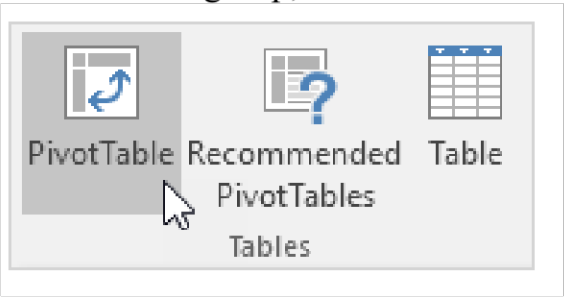
II. Create pivot table of information of monthly summary quantity of arrival passengers to Boryspil from each departure airport.

III. Identify the most popular type of aircraft for AeroSvit flights.

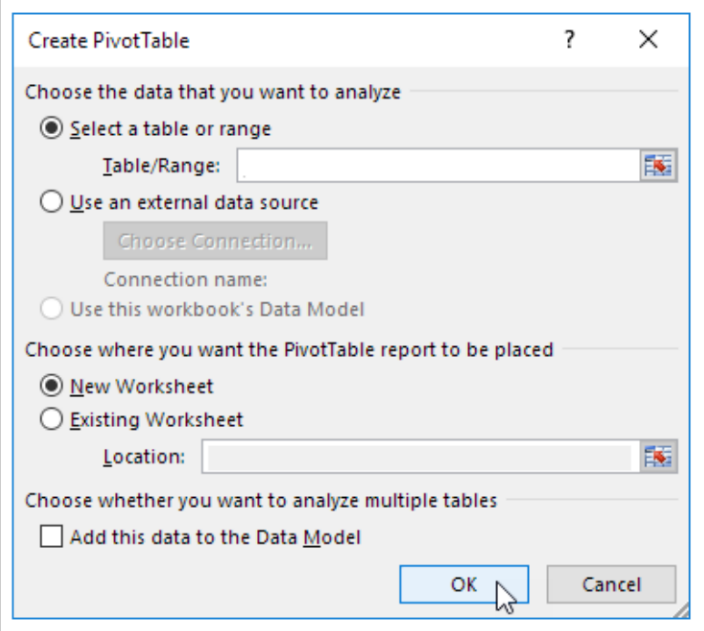
IV. Identify the airline with the highest traffic load.

To insert a pivot table, execute the following steps.

1. Click any single cell inside the data set.
2. On the Insert tab, in the Tables group, click PivotTable.



The following dialog box appears. Excel automatically selects the data for you. The default location for a new pivot table is New Worksheet.



After selecting all arrival table, click OK.

The PivotTable Fields pane appears. To get the total amount exported of each product, drag the following fields to the different areas.

MODULE 1 "LOCAL AND GLOBAL E-LOGISTICS SOLUTIONS"

Laboratory Class #17

Module Test