NORTHEASTERN UNIVERSITY

Department of Mechanical and Industrial Engineering

Supply Chain Engineering **Prof. Gupta**

IE 7200 **Spring 2014 (Mondays)**

Homework No. 4
(Solution)

Problem 1.

Plan 1

Month	Production		Total Production	Forecasted Demand	Inventory Change	Inventory Balance with 50 on hand
	RT	OT				
Jan	88		88	50	38	88
Feb	72		72	60	12	100
Mar	92		92	70	22	122
Apr	84		84	65	19	141
May	88		88	55	33	174
Jun	84		84	80	4	178
Jul	80		80	250	-170	8
Aug	100	15	115	250	-135	-127
Sep	110	20	130	110	20	-107
Oct	110	20	130	100	30	-77
Nov	105	15	120	80	40	-37
Dec	100	10	110	60	50	13
Total	1113	80	1193	1230		

Cost of Plan 1

Hiring/Layoff costs =	400 + 500 =	$ 900
Inventory Cost =	(88+100+122+141+174+178+8+13) * 25 =	$ 20,600
Shortage Cost =	(127+107+77+37) * 50 =	$ 17,400
Production Cost =	1113 * 300 + 80 * 400 =	$ 365,900
Total Cost =		$404,800

Plan 2

Month	Production		Total Production	Forecasted Demand	Inventory Change	Inventory Balance with 50 on hand
	RT	OT				
Jan	88		88	50	38	88
Feb	72		72	60	12	100
Mar	92		92	70	22	122
Apr	105		105	65	40	162
May	110		110	55	55	217
Jun	105		105	80	25	242
Jul	100		100	250	-150	92
Aug	100		100	250	-150	-58
Sep	110		110	110	0	-58
Oct	110		110	100	10	-48
Nov	105		105	80	25	-23
Dec	100		100	60	40	17
Total	1197		1197	1230		

Cost of Plan 2

Hiring/Layoff costs =	400 + 500 =	$ 900
Inventory Cost =	(88+100+122+162+217+242+92+17)*25 =	$ 26,000
Shortage Cost =	(58+58+48+23) * 50 =	$ 9,350
Production Cost =	1197 * 300 + 0 * 400 =	$359,100
Total Cost =		$395,350

Plan 3

Month	Production		Total Production	Forecasted Demand	Inventory Change	Inventory Balance with 50 on hand
	RT	OT				
Jan	66		66	50	16	66
Feb	54		54	60	-6	60
Mar	69		69	70	-1	59
Apr	63		63	65	-2	57
May	66		66	55	11	68
Jun	63		63	80	-17	51
Jul	60		60	250	-190	-139
Aug	100	15	115	250	-135	-274
Sep	110	20	130	110	20	-254
Oct	110	20	130	100	30	-224
Nov	105	15	120	80	40	-184
Dec	100	10	110	60	50	-134
Total	966	80	1046	1230		

Cost of Plan 3

Hiring/Layoff costs =	400 *2 + 500 * 2 =	$ 1,800
Inventory Cost =	(66+60+59+57+68+51) * 25 =	$ 9,025
Shortage Cost =	(139+274+254+224+184+134) * 50 =	$ 60,450
Production Cost =	966 * 300 + 80 * 400 =	$ 321,800
Total Cost =		$393,075

Comparing the costs of all three plans, we find that the **total cost of Plan 3 is minimum**.

Problem 2.
The optimal transportation matrix and solution are as follows:

Source		Period				Final		
Period		1	2	3	4	Inv.	XC	Capacity
1	In House	20 **30**	25	30	35	40	0	30
	Outside	26 **10**	31	36	41	46	0 **50**	60
2	In House		20 **40**	25	30	35	0	40
	Outside		26 **40**	31	36	41	0 **20**	60
3	In House			21 **60**	26	31	0	60
	Outside			26 **40**	31 **20**	36	0	60
4	In House				22 **40**	27 **20**	0	60
	Outside				26 **60**	31	0	60
Demand		40*	80	100	120	20	70	

*Demand for period 1 = 60 - initial inventory = 60 - 20 = 40.

The optimal aggregate plan is as follows:

In period one: Produce 30 units in-house and procure 10 units from outside.
In period two: Produce 40 units in-house and procure 40 units from outside.
In period three: Produce 60 units in-house and procure 60 units from outside.
In period four: Produce 60 units in-house and procure 60 units from outside.

Total cost = 30*20+10*26+40*20+40*26+60*21+40*26+20*31+40*22+20*27+60*26
= $8600.