Yifu He 190003956.

Problem 1.

10 types of currencies. target.

① Final position $\geq$ Desired position

② max portfolio value measured in \$.

$\Rightarrow$ Linear programming

$$\max \sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{n} x_{ij}}{r_{\$i}}\right) \quad \text{subject to. ① } \sum r_{ij} \cdot \vec{x_{ij}} = \vec{a_j}$$

$$② .\ \mathrm{sum}(\vec{x_{ij}}) \geq b_i \ , \forall i = 1, 2, \cdots 10$$

$$③\ x_{ij} \geq 0 .\ \forall i = 1, 2, \cdots 10,\ j = 1, 2, \cdots 10.$$

the outcome is shown in excel.

final position is 60 25 6 2 20 13.35 3. 1807 40 13.

Final portfolio value measured in dollar is \$ 154.64

Problem 2.

In this model we make avaliable \$100 in USD to purchase other currency. and pump through the system. In the end, if our portfolio is higher than \$100, the arbitrage exists.

~~Max: D - Σ~~

use ① $\sum_{i=1}^{10} x_{ij} = \text{Cashin}^{(j)}$ of j

② . $\sum_{i=1}^{n} x_{ij} \cdot r_{ij} = \text{Castout}^{(j)}$ of j

$$\max: \sum_{j=1}^{n} \text{Cashin}^{(j)} . r_{\$j}$$

subject to: $\vec{\text{Cashin}} \geq \vec{\text{Cashout}}$

$$\sum_{j=1}^{n} \text{Cashout}^{(j)} . r_{\$j} \leq 100$$

$\Rightarrow$ the result in excel shows that the final value of portfolio is about \$ 100.32. > \$100, profit exists.

	Initial Position	Desired Position
EUR	70	60
USD	20	25
AUD	8	6
GBP	3	2
NZD	15	20
CAD	7	8
CHF	2	3
JPY	1,500	1,800
HKD	35	40
SGD	18	13

Cross rates

		EUR	USD	AUD	GBP	NZD	CAD	CHF	JPY	HKD	SGD
Currency Purchased	(buy)EUR	1	1.09875	1.63	0.9	1.741	1.462	1.087	116.795	8.6188	1.5247
	USD	0.9082	1	1.48	0.82	1.584	1.331	0.989	106.249	7.8411	1.3872
	AUD	0.6133	0.67336	1	0.55	1.067	0.896	0.666	71.548	5.2825	0.9345
	GBP	1.1067	1.21602	1.81	1	1.927	1.618	1.204	129.229	9.5389	1.6875
	NZD	0.5746	0.63086	0.94	0.52	1	0.84	0.624	67.013	4.9494	0.8756
	CAD	0.6837	0.75123	1.11	0.62	1.185	1	0.743	79.793	5.891	1.0421
	CHF	0.9168	1.01025	1.5	0.83	1.6	1.349	1	107.331	7.9217	1.4016
	JPY	0.0085	0.00941	0.01	0.01	0.015	0.013	0.009	1	0.0736	0.013
	HKD	0.1158	0.12747	0.19	0.1	0.202	0.17	0.126	13.5531	1	0.1766
	SGD	0.6543	0.7216	1.07	0.59	1.138	0.988	0.714	76.6175	5.6532	1

question1

position		EUR	USD	AUD	GBP	NZD	CAD	CHF	JPY	HKD	SGD	final
	(buy)EUR	36.955	17.73304	0	0	0	4.788	0	0	0.5238	0	60
	USD	25	0	0	0	0	0	0	0	0	0	25
	AUD	0	0.766037	0	0	0	0	3.001	2.23263	0	0	6
	GBP	2	0	0	0	0	0	0	0	0	0	2
	NZD	0	0	0	0	0	0	0	20	0	0	20
	CAD	0	0	7.2	4.88	1.271	0	0	0	0	0	13.351
	CHF	3	0	0	0	0	0	0	0	0	0	3
	JPY	0	0	0	0	0	0	0	0	414.32	1385.7	1800
	HKD	40	0	0	0	0	0	0	0	0	0	40
	SGD	1.1398	0	0	0	11.86	0	0	0	0	0	13
	initial position	70.00	20.00	8.00	3.00	15.00	7.00	2.00	1,500.00	35.00	18.00	**Objective**
	mesured in dollar	66.065	25	4.04	2.43	12.63	10.03	3.032	16.9413	5.1013	9.3713	154.643
		77.076	20	5.39	3.65	9.469	5.26	2.022	14.1178	4.4637	12.976	154.421

question2		EUR	USD	AUD	GBP	NZD	CAD	CHF	JPY	HKD	SGD	cash in
	(buy)EUR	0	0	0	0	0	0	0	0	0	0	0
	USD	0	0	0	0	0	1E-15	0	0.31966	0	0	0.31966
	AUD	0	0	0	0	0	0	0	0	0	0	0
	GBP	0	0	0	0	0	0	0	0	0	0	0
	NZD	0	0	0	0	0	0	0	52.5835	0	0	52.5835
	CAD	0	0	0	0	0	0	0	0	0	0	0
	CHF	1E-14	0	0	0	0	0	0	0	0	0	1.4E-14
	JPY	0	0	0	0	0	0	0	0	0	3557.7	3557.74
	HKD	0	0	0	0	0	0	0	0	0	0	0
	SGD	0	0	0	0	46.22	0	0	0	0	0	46.2151
	cash out	0.00	0.00	0.00	0.00	52.58	0.00	0.00	3,557.74	0.00	46.22	
		initial	100									
		objecti	100.3197									