HOMEWORK 2.

1.: A company holds 1.2 billion Japanese Yen, 10.5 billion Indonesian rupiahs, and 28 million Malaysian ringgits. Here are the exchange rates and transaction costs. JY = Japanese Yen, IR = Indonesian Rupiah, MR = Malaysian Ringgit, UD + US$, CD = Canadian$, EE = European Euro, EP = English Pound, MP = Mexican Peso.

From	Exchange Rate to							
	JY	IR	MR	UD	CD	EE	EP	MP
JY	1	50	0.04	0.008	0.01	0.0064	0.0048	0.0768
IR		1	0.0008	0.00016	0.0002	0.000128	0.000096	0.001536
MR			1	0.2	0.25	0.16	0.12	1.92
UD				1	1.25	0.8	0.6	9.6
CD					1	0.64	0.48	7.68
EE						1	0.75	12
EP							1	16
MP								1

From	Transaction cost %							
	JY	IR	MR	UD	CD	EE	EP	MP
JY		0.5	0.5	0.4	0.4	0.4	0.25	0.5
IR			0.7	0.5	0.3	0.3	0.75	0.75
MR				0.7	0.7	0.4	0.45	0.5
UD					0.15	0.2	0.2	0.2
CD						0.2	0.1	0.1
EE							0.05	0.5
EP								0.5
MP								

(i): Formulate the problem of finding the most cost effective method to convert these holdings into US$ as a min cost flow problem.

(ii): Suppose there are transaction limits for converting Yen, Rupiah, and Ringgits (only these currencies, no limits for converting other currencies) as shown in the following table (unit = equivalent of UD1000,000). Then find the most cost effective way of converting as much of these currency holdings into US$ as possible.

From	Transaction Limits							
	JY	IR	MR	UD	CD	EE	EP	MP
JY		5	5	2	2	2	4	8
IR	5		2	1	2	1	3	2
MR	3	5		2	3	3	2	1

2: There are 10 cities, we will denote them by SP, K, P, U, M, SAM, O, SAR, Y, R. Among these M is going to be the headquarters for a multinational company. The company has already established communication links between pairs (M, SP), and (M, R).

Each communication link joining a pair of cities serves for communication both ways.

The company wants to establish communication links between M and the remaining 7 cities at minimum cost. Two cities can communicate as long as there is a path between them.

It is possible to establish a communication link between the following pairs of cities with the associated costs (unit = \$100,000) as shown in the following table.

Pair	Cost	Pair	Cost	Pair	Cost
(SP, K)	210	(R, SAR)	200	(P, U)	125
(SP, P)	185	(R, O)	120	(Y, U)	125
(SP, U)	225	(K, P)	150	(U, SAM)	100
(M, U)	310	(K, U)	105	(U, O)	75
(M, SAM)	195	(K, SAR)	95	(SAR, SAM)	100
(M, O)	440	(P, Y)	85	(SAR, O)	95
(M, SAR)	200				

It is required to determine which of these communication links be built to make sure that M can communicate with all the other cities at minimum cost. Formulate using a network model.