Exercise 1.1

The number of association rules is calculated by the formula $3^d - 2^{(d+1)} + 1$
Proof:
If we have d items then we can form $2^d - 1$ subsets and each of these sets can be mapped with multiple other subsets and in particular each subset can be mapped with subsets that dont contain any similar items so for a subset with length K the number of subsets that can be mapped to it is $2^{(d-k)} - 1$
Now we have to sum all possibilities for that

$R = \sum_{k=1}^{d} \binom{d}{k}(2^{(d-k)} - 1) = \sum_{k=1}^{d} \binom{d}{k}2^{(d-k)} - \sum_{k=1}^{d} \binom{d}{k}$

Since $\sum_{k=1}^{d-1} \binom{d}{k} = 2^d - 1$ therefore

$R = \sum_{k=1}^{d} \binom{d}{k}2^{(d-k)} - 2^d + 1$

Since $3^d = \sum_{k=1}^{d} \binom{d}{k}2^{d-k} + 2^d$

then $\sum_{k=1}^{d} \binom{d}{k}2^{d-k} = 3^d - 2^d$

So $R = 3^d - 2^d - (2^d) + 1 = 3^d - 2^{(d+1)} - 1$

Exercise 1.2

First we find all frequent items for k =1

item	count
A	1
C	2
D	1
E	4
K	5
M	3
N	2
O	3
U	1
Y	3

So F1 = {E, K, M, O, Y}

Now we find C2 from F1

C2 = {Ek, EM, EO, EY, KM, KO, KY, MO, MY, OY}

And we check each itemset to see if it is frequent

So F2 = {Ek, EO, KM, KO, KY} because all other itemsets have frequency <3

Now we find C3 from F2, and we we can only form EKO from EK,EO,KO

C3 = {EKO}

And we check this itemset to see if it is frequent

and we notice that it is frequent as it appears 3 times
So F3 = {EKO}

We cant form any candidates anymore and so all frequent items are

F = {E, K, M, O, Y, EK, EO, KM, KO, KY, EKO}