Assignment 3

Task 2

a)

We have set A = {LMNOPQRS}.
And FD's set B = { N→M, NO→LR, NQR→MP, P→R, Q→NO }

Initial closures for each FD in B

N^+ → MN
NO^+ → LMNOR
NQR^+ → LMNOPQR
P^+ → PR
Q^+ → LMNOPQR

FD's in standart form, removing redundancy:
N → M
NO → L
NO → R
NQR → M (because N → M)
NQR → P (because Q→NO and NO→R)
P → R
Q → N
Q → O

Closures after updation:
N^+ → MN
NO^+ → LMNOR
NQR^+ → LMNOPQR
P^+ → PR
Q^+ → LMNOPQR

As we seem nothing changed, so minimal basis holds.

Minimal basis:
N → M
NO → L
NO → R
P → R
Q → N
Q → O
Q → P

b)

Searching for key in :
N → M (because Q→N and N→M) – now Q → M
NO → L (because Q→NO and NO→R) – now Q → L
NO → R (because Q→NO and NO→R) – now Q → R
NQR → M (because N → M)
NQR → P (because Q→NO and NO→R)
P → R (because Q→NO and NO→R and Q→P and P→R)
Q → N
Q → O

Key candidates:
Q^+ → LMNOPQR (gives full closure except S)
Q is on the LHS only so it always has to be in key
S doesn't appear on LHS or RHS so it also always has to be a key
Therefore, we have a key "QS" and adding other attributes is obviously unnecessary (since they all are already defined by Q)

Key:
QS

c) Recall FD's we have in minimal basis:
N → M
NO → LR
P → R
Q → NOP

Our resulting set of relations would have these attributes:
R1(N,M), R2(N,O,L,R), R3(P,R), R4(Q,N,O,P)

As we see, there is no repetitions in tables, none of them can be eliminated

Since we have a key QS, and there is no S in this relations, we should add R0(Q,S) for storing the key

Eventually, we get such set of relations:
R0(Q,S), R1(N,M), R2(N,O,L,R), R3(P,R), R4(Q,N,O,P)

d) It doesn't allow redundancy since the relations are formed from minimal basis FD's, none of the relations was removed during 3NF-decomposition and each FD's LHS is a superkey for relation it formed.