

## Task 1

$R = (P, Q, R, S, T, U, V, W)$

$RW \rightarrow V$

$P \rightarrow QR$

$T \rightarrow P$

$U \rightarrow TV$

i) Determine the highest normal form, which is valid for a schema. Justify your answer. Justification must include the derivations of minimal keys from the functional dependencies and testing the validity of all normal forms (2NF, 3NF, BCNF) against the relational schemas, minimal keys, and functional dependencies.

ii) If a schema is not in BCNF, then decompose it into a minimum number of schemas so that each one of them is in BCNF. Justify your answer.

**Ans i):**

using closure:

$\{RW\} = \{RWV\}$

$\{P\} = \{PTQR\}$

$\{T\} = \{PQRV\}$

$\{U\} = \{UTVPQR\}$

using augmentation:

$USW \rightarrow UTVPQRSW$

USW is MSK

Normal form check:

(1NF) any multi-value attributes? - No

(2NF) any partial dependencies? - Yes

$U \rightarrow TV$

R is in 1NF

**Ans ii):**

(2NF) remove partial dependencies

R1(UTV) PK=U

R2(TPQR) PK=T

R3(RWV) PK=RW

Normal form check:

(2NF) any partial FDs? - No

(3NF) any transitive FDs? - Yes

$P \rightarrow QR$

(3NF) remove transitive FDs

R1(UTV) PK=U

R2(TP) PK=T

R3(PQR) PK=P

R4(RWV) PK=RW

Normal form check:

(3NF) are there any transitive FDs? - No

(BCNF) are all determinants candidate keys? - Yes