

### QUESTION 3 (20 MARKS)

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- i. Consider a relation **R(A, B, C, D, E, F, G, H, I, J, K)** with the following functional dependencies (FD1 to FD5) that exist between these attributes and answer all questions (a –c) based of Figure 3 below.

<u>A</u>	<u>B</u>	C	D	E	F	G	H	I	J	K
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**FD1:**  $A, B \rightarrow D, E, F$  (Primary Key)

**FD2:**  $A \rightarrow C$

**FD3:**  $B \rightarrow G, H, I, J, K$

**FD4:**  $D \rightarrow F$

**FD5:**  $H \rightarrow I, J, K$

**FIGURE 3: Functional dependencies for relation R**

- a) Identify functional dependencies type for each FD2, FD3, FD4 and FD5. (2 marks)
- b) By considering all the functional dependencies in Figure 3, write the 1NF relation schema. Identify the primary key for the 1NF relation. (3 marks)
- c) Based on the answer in (b), produce the 2NF and 3NF relation schema. Identify the primary key for all relations. (5 marks)

#### QUESTION 4 (15 MARKS)

**Table 4.1** lists the loan application data. Each application is handled by a specific banker. A client can apply for multiple types of loan from the bank.

**Table 4.1:** Loan application data

clientNo	clientName	staffNo	staffName	loanType	loanAmount	applicationDate
C0011	Hilmi	S0021	Ahmad	Car Loan	RM80000.00	12 Oct 2018
C0012	James	S0021	Ahmad	Personal Loan Personal Loan	RM20000.00 RM15000.00	30 Sep 2018 28 Sep 2018
C0013	Jones	S0021	Ahmad	House Loan	RM600000.00	12 Oct 2018
C0011	Hilmi	S0033	Sue Ann	House Loan	RM560000.00	17 Aug 2018
C0014	Amirah	S0033	Sue Ann	Car Loan	RM76000.00	16 Sep 2018
C0013	Jones	S0042	Joseph	Car Loan	RM60000.00	15 Oct 2018
C0011	Hilmi	S0042	Joseph	Personal Loan	RM30000.00	29 Aug 2018

Based on the table above, answer the following questions:

- Identify **ONE** anomaly that exists in the table 4.1 above and provide the example based on the data in table above. (2 marks)
- Identify the level of Normal Form for Table 4.1. Justify your answer. (2 marks)
- Identify all the functional dependencies that can be derived from Table 4.1. (4 marks)
- Normalize the relation in Table 4.1 up to Third Normal Form (3NF). Illustrate the process of the normalization and state any assumptions. (7 marks)

### Qu. Ans-3

a) FD2  $\rightarrow$  Full function dependency

FD3  $\rightarrow$  Partial ~ ~

FD4  $\rightarrow$  Partial ~ ~

FD5  $\rightarrow$  Full ~ ~

b) 1NF Relation Schema:

R (A, B, C, D, E, F, G, H, I, J, K)

Primary key for the 1NF relation:

(A, B) FK = no

c) Produce 2NF & 3NF relation schema:

1NF = R<sub>1</sub> (A, B, C, D, E, F, G, H, I, J, K)

2NF = R<sub>a</sub> (A, B, ~~C~~, D, E, F) [from FD1]

R<sub>b</sub> (A, C) [from FD2]

R<sub>c</sub> (B, G, H, I, J, K) [from FD3]

$\therefore$  2NF = (A, B, C, D, E, F)

R<sub>a</sub>: PK is  $\rightarrow$  A, B

R<sub>b</sub>: PK is  $\rightarrow$  A

FK is  $\rightarrow$  A, B

FK is  $\rightarrow$  No

R<sub>c</sub>: PK is  $\rightarrow$  B

FK is  $\rightarrow$  No.

3NF:

$R_{a,1} (A, B, C, D, E, H)$

PK is  $\rightarrow A, B$

FK  $\rightarrow D, H$

$R_b (A, c)$

PK  $\rightarrow A$

FK  $\rightarrow$  No

$R_{c,1} (B, G, H)$

PK  $\rightarrow B$

FK  $\rightarrow$  No

$R_d (D, F)$

PK  $\rightarrow$  No

FK  $\rightarrow$  No

$R_e (H, I, J, K)$

PK  $\rightarrow$  No

FK  $\rightarrow$  No.

### Qu. Ans - 4

a) One anomaly is deletion anomaly is if we delete the details of the ClientNo called 00011 we also lose the loan type when clientNo. called 00011.

b) Table 4.1 is 1NF

it appears that the intersection of each row & column in table 4.1 contains only one value.

c) FD1  $\rightarrow \frac{\text{ClientNo}}{\text{PK}}, \frac{\text{applicationDate}}{\text{PK}} \rightarrow \text{ClientName, staff No, staff Name.}$   
loan type (functional dependency)

FD2  $\rightarrow \frac{\text{ClientNo}}{\text{PK}} \rightarrow \text{staff Name (Partial dependency)}$

FD3  $\rightarrow \text{ClientNo, } \frac{\text{applicationDate}}{\text{PK}} \rightarrow \text{loan type (Partial dependency)}$

FD4  $\rightarrow \text{staff No} \rightarrow \text{staff Name (transitive dependency)}$

- \* A client have more than one applicationDate.
- \* One client can take loan more.

① 1NF:

Loan application data (clientNo, clientName, staffName, staffNo, loanType, loanAmount, applicationDate)

2NF:

FD2 & FD3 contravene 2NF

Loan application data (clientNo, staffNo, applicationDate, clientName)

client (clientNo, clientName)

application data (staffNo, applicationDate, clientNo)

3NF:

FD4 contravene 3NF

Loan application data (clientNo, applicationDate, clientName)

client (clientNo, clientName)

application data (staffNo, applicationDate, clientNo)

staff (staffNo, staffName)