EIE3112 Database Systems
Tutorial: Normalization

Q1. The following table contains typical flat rental information.

CustNo	Cname	PropNo	Paddress	RenStart	RenFinish	Rent	OwnNo	Oname
C111	John Chan	PG004 PG115	6 Dive Road. 5 Nowar Drive.	1-Jul-04 1-Sep-06	31-Aug-06 1-Sep-08	1500 2000	O156 O193	Tim Lee Tony Chan
C145	Alice Lau	PG004 PG036 PG116	6 Dive Road. 2 Manor Road 8 Nowar Drive	1-Sep-02 10-Oct-04 1-June-06	10-June-04 1-Dec-05 10-Aug-06	1000 1450 2200	O156 O156 O189	Tim Lee Tim Lee Ben Li

- CustNo: the unique customer number assigned to each customer
- Cname: the name of the customer
- PropNo: the unique number assigned to each property
- Paddress: the address of the property
- RenStart: the starting date of renting a property
- RenFinish: the end date of renting a property
- Rent: the amount of the rent
- OwnNo: the unique number assigned to the owner of a property
- Oname: the name of the owner of a property

Given the following functional dependencies

CustNo → Cname
PropNo → Paddress, OwnNo, Oname
OwnNo → Oname
CustNo, PropNo → RenStart, RenFinish, Rent

Normalize the table to 1NF, then 2NF, and finally 3NF. Write your answer in the following form:

Relation(<u><attribute></u>,<attribute>,…,<attribute>)

Underline the key(s).

Q2. The following shows a typical inspection report.

Page *1* — ***DreamHome*** Property Inspection Report — Date *1-Oct-98*

Property Number *PG4* Property Address *6 Lawrence St, Glasgow*

Inspection Date	Inspection Time	Comments	Staff Number	Staff Name	Car Reg
18-Oct-96	10.00	Need to replace crockery	SG37	Ann Beech	M231 JGR
22-Apr-97	09.00	In good order	SG14	David Ford	M533 HDR
1-Oct-98	12.00	Damp rot in bathroom	SG14	David Ford	N721 HFR

An inspection report summarizes details regarding visits to a particular property. It contains the inspection date, inspection time, and the comment given by a particular staff. Note that a car (with a car registration

number) would be assigned to a particular staff on a particular day for property inspection. A property will only be inspected once on the same day. Sample data is shown below:

PropNo	Paddress	Idate	Itime	Comments	StaffNo	Sname	CarReg
PG4	6 Lawrence St	18-Oct-96	10:00	Need to replace crockery	SG37	Ann Beech	M231 JGR
		22-April-97	09:00	In good order	SG14	David Ford	M533 HDR
		1-Oct-98	12:00	Damp rot in bathroom	SG14	David Ford	N721 HFR
PG16	5 Novar Dr	22-Apr-97	13:00	Replace living room carpet	SG14	David Ford	M533 HDR
		24-Oct-97	14:00	Good condition	SG37	Ann Beech	N721 HFR

Given the following functional dependencies,

PropNo → Paddress
PropNo, Idate → Itime, Comments, StaffNo, Sname, CarReg
StaffNo → Sname

transform the table to 1NF, then 2NF, and finally 3NF. Write your answer in the following form:

Relation(<u>attribute</u>,<attribute>,…,<attribute>)

Underline the key(s).

Q3. The following table shows the information of a table called "Stock".

PartNo	**PartDesc**	**Quantity**
P2	Nut	5000
P1	Bolt	8300
P3	Washer	9750
P4	Nut	2326

Stock

a) Identify the *possible* functional dependencies merely by inspecting the content of the table. Suggest which of the FDs is(are) unlikely a business rule. Why?

b) Suppose the content of "Stock" is changed to the one shown below, could you be certain, merely by inspecting the new table, as to whether Quantity is a determinant of PartNo and/or PartDesc?

PartNo	**PartDesc**	**Quantity**
P2	Nut	5000
P1	Bolt	5000
P3	Washer	9750
P4	Nut	2326

Stock

c) Suppose the content of "Stock" is changed to the one shown below, could you be certain, merely by inspecting the new table, as to whether Quantity is a determinant of PartNo and/or PartDesc?

PartNo	**PartDesc**	**Quantity**
P2	Nut	5000
P1	Bolt	8300
P3	Washer	9750
P4	Nut	5000

Stock

Q4. A table is defined as:

Employee (EmployeeNo, EmployeeName, Salary)

Each employee has a unique EmployeeNo that distinguishes him/her from any other employee. Known enterprise rules are that an employee has only one name and salary, but different employees may have the same name and/or the same salary. Discuss the possibility of the following functional dependencies meeting the enterprise rules.

a) EmployeeNo → EmployeeName, Salary
b) EmployeeName → EmployeeNo and/or Salary → EmployeeNo
c) EmployeeName → Salary and/or Salary → EmployeeName

Q5. Discuss the drawbacks of the following table.

SALESPERSON/PRODUCT table

Salesperson Number	Product Number	Salesperson Name	Commission Percentage	Year of Hire	Department Number	Manager Name	Product Name	Unit Price	Quantity
137	19440	Baker	10	1995	73	Scott	Hammer	17.50	473
	24013						Saw	26.25	170
	26722						Pliers	11.50	688
186	16386	Adams	15	2001	59	Lopez	Wrench	12.95	1745
	19440						Hammer	17.50	2529
	21765						Drill	32.99	1962
	24013						Saw	26.25	3071
204	21765	Dickens	10	1998	73	Scott	Drill	32.99	809
	26722						Pliers	11.50	734
361	16386	Carlyle	20	2001	73	Scott	Wrench	12.95	3729
	21765						Drill	32.99	3110
	26722						Pliers	11.50	2738

Q6. Remove the repeating group of the following table, i.e., normalize the table to 1NF. Then, split the table into two tables so that the resulting tables become 2NF.

supplierNo	supplierName	partNo
S5	Wells	P1
S2	Heath	P1, P4
S7	Barron	P6
S9	Edwards	P8, P2, P6

Q7. Normalize the following table to 2NF.

PartSupplier

partNo	Supplier	
	supplierNo	supplierName
P1	S5	Wells
	S2	Heath
P4	S2	Heath
P6	S7	Barron
	S9	Edwards
P8	S9	Edwards
P2	S9	Edwards

Q8 Given the following table

CustNo	CustName	CustTel	ProdNo	ProdName	UnitCost	OrderNo	Qty
C1	Peter	1234567	P1	Shoes	10	O1	1
C1	Peter	1234567	P2	Bottle	20	O1	2
C1	Peter	1234567	P1	Shoes	10	O2	4
C2	Paul	7654321	P4	Cup	40	O3	2
C2	Paul	7654321	P5	Disk	50	O4	1
C2	Paul	7654321	P3	Dress	30	O4	1

(a) Identify the functional dependencies.
(b) Normalize the table to 3NF (Hints: you may need to use 4 tables and provide proper names for these tables).

Q9 Consider the following relation:

PO_Number	ItemNum	PartNum	Description	Price	Qty
O101	I01	P99	Plate	$3.00	7
O101	I02	P98	Cup	$1.00	11
O101	I03	P77	Bowl	$2.00	6
O102	I01	P99	Plate	$3.00	5
O102	I02	P77	Bowl	$2.00	5
O103	I01	P33	Fork	$2.50	8

(a) What happens if we want to add the fact that Order O103 has 5 units (Qty = 5) of Part P99? Identify the type of anomaly caused by this operation.

(b) What happens when we delete item I02 from Order O101? Identify the type of anomaly caused by this operation.
(c) What happens if we want to change the price of the Plate (P99)? Identify the type of anomaly caused by this operation.
(d) Convert the relation into 3NF.

Q10 Consider the following 1NF relation:

STOCK(Company, Symbol, Headquarters, Date, ClosePrice)

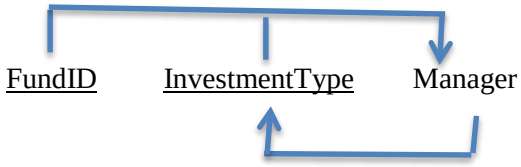
Company	Symbol	Headquarters	Date	Close Price
Microsoft	MSFT	Redmond, WA	09/07/2013	23.96
Microsoft	MSFT	Redmond, WA	09/08/2013	23.93
Microsoft	MSFT	Redmond, WA	09/09/2013	24.01
Oracle	ORCL	Redwood Shores, CA	09/07/2013	24.27
Oracle	ORCL	Redwood Shores, CA	09/08/2013	24.14
Oracle	ORCL	Redwood Shores, CA	09/09/2013	24.33

(a) Identify the functional dependencies. Hence, explain why the relation is not in 2NF.
(b) Convert the relation to 2NF
(c) Convert the relation to 3NF

Q11 Consider the following relation and FD:

FundID	InvestmentType	Manager
99	Common Stock	Smith
99	Municipal Bonds	Jones
33	Common Stock	Green
22	Growth Stocks	Brown
11	Common Stock	Smith

FD1: FundID, InvestmentType → Manager
FD3: Manager → InvestmentType



Note that

- A Fund consists of one or more Investment Types (e.g., Fund 99 has Common Stock and Municipal Bonds).
- A Fund is managed by one or more Managers (e.g., Fund 99 is managed by Smith and Jones)
- An Investment Types can have one or more Managers (e.g. Common Stock is managed by Smith and Green)
- A Manager only manages one investment type.

Is the relation in 1NF, 2NF or 3NF?