Solutions normalization

- **Normalise up to 3NF (note: a procedure may occur on multiple dates)**

Pet_id	Pet_name	Pet_type	Pet_age	owner	Visit_date	procedure
246	Rover	dog	12	Sam Coock	2002-01-13	01 – Rabies vaccination
					2005-03-27	10 - Examination
					2003-04-02	05 – Heart worm test
296	Spot	dog	2	Terry Kim	2002-01-21	08 – Tetanus vaccination
					200-03-10	05 – Heart worm test
341	Morris	cat	4	Sam Coock	2001-01-23	01– Rabies vaccination
					2002-01-13	01 – Rabies vaccination
519	Tweedy	bird	2	Terry Kim	2002-04-30	20 – Check up
					2002-04-30	12 – Eye wash

UNF: Pet [pet_id, pet_name, pet_type, pet_age, owner, (visitdate, procedure_no, procedure_name)]

1NF: Pet [pet_id, pet_name, pet_type, pet_age, owner]
Pet_Visit [pet_id, visitdate, procedure_no, procedure_name]

note: a procedure may occur on multiple dates, therefore visitdate is included as part of the key

2NF: Pet [pet_id, pet_name, pet_type, pet_age, owner]
Pet_Visit [pet_id, visitdate, procedure_no]
Procedure [procedure_no, procedure_name]

3NF: same as 2NF

- **Normalise up to 3NF**

INVOICE

HILLTOP ANIMAL HOSPITAL DATE: JAN 13/2002
INVOICE # 987

MR. RICHARD COOK
123 THIS STREET
MY CITY, ONTARIO
Z5Z 6G6

PET	PROCEDURE	AMOUNT
ROVER	RABIES VACCINATION	30.00
MORRIS	RABIES VACCINATION	24.00
	TOTAL	54.00
	TAX (8%)	4.32
	AMOUNT OWING	58.32

UNF: invoice [invoice_no, invoice_date, cust_name, cust_addr, (pet_name, procedure, amount)]

1NF: invoice [invoice_no, invoice_date, cust_name, cust_addr]
invoice_pet [invoice_no, pet_id, pet_name, procedure, amount]

2NF: invoice [invoice_no, invoice_date, cust_name, cust_addr]
invoice_pet [invoice_no, pet_id, procedure, amount]
pet [pet_id, pet_name]

3NF: invoice [invoice_no, invoice_date, cust_no (FK)]
invoice_pet [invoice_no (FK), pet_id (FK), procedure, amount]
pet [pet_id, pet_name]
customer [cust_no, cust_name, cust_street, cust_city, cust_pstlcd]

- **Normalise up to BCNF**

Grade_report(StudNo,StudName,(Major,Adviser,(CourseNo,Ctitle,InstrucName,InstructLocn,Grade)))

Functional dependencies

StudNo -> StudName
CourseNo -> Ctitle,InstrucName
InstrucName -> InstrucLocn
StudNo,CourseNo,Major -> Grade
StudNo,Major -> Advisor
Advisor -> Major

UNF

Grade_report(StudNo,StudName,(Major,Advisor, (CourseNo,Ctitle,InstrucName,InstructLocn,Grade)))

1NF Remove repeating groups

Student(StudNo,StudName)
StudMajor(StudNo,Major,Advisor)
StudCourse(StudNo,Major,CourseNo, Ctitle,InstrucName,InstructLocn,Grade)

2NF Remove partial key dependencies

Student(StudNo,StudName)
StudMajor(StudNo,Major,Advisor)
StudCourse(StudNo,Major,CourseNo,Grade)
Course(CourseNo,Ctitle,InstrucName,InstructLocn)

3NF Remove transitive dependencies

Student(StudNo,StudName)
StudMajor(StudNo,Major,Advisor)
StudCourse(StudNo,Major,CourseNo,Grade)
Course(CourseNo,Ctitle,InstrucName)
Instructor(InstructName,InstructLocn)

BCNF Every determinant is a candidate key

Student : only determinant is StudNo
StudCourse: only determinant is StudNo,Major
Course: only determinant is CourseNo
Instructor: only determinant is InstrucName
StudMajor: the determinants are
StudNo,Major, or
Adviser

Only StudNo,Major is a candidate key.

BCNF

Student(StudNo,StudName)
StudCourse(StudNo,Major,CourseNo,Grade)
Course(CourseNo,Ctitle,InstrucName)
Instructor(InstructName,InstructLocn)
StudMajor(StudNo,Advisor)
Adviser(Adviser,Major)

- **What normal form is this? Convert to BCNF**

video(title,director,serial)
customer(name,addr,memberno)
hire(memberno,serial,date)

Functional dependencies

title->director,serial
serial->title
serial->director
name,addr -> memberno
memberno -> name,addr
serial,date -> memberno

No repeating groups, so at least 1NF

2NF? There is a composite key in hire. Investigate further... Can memberno in hire be found with just serial or just date. NO. Therefore relation is in at least 2NF.

3NF? serial->director is a non-key dependency. Therefore, the relations are currently in 2NF.

Convert from 2NF to 3NF.

video(title,serial)
serial(serial,director)
customer(name,addr,memberno)
hire(memberno,serial,date)

In BCNF? Check if every determinant is a candidate key.

video(title,serial)
title->director,serial Candidate key
serial->title Candidate key
→video in BCNF
serial(serial,director)
Determinants are: serial->director Candidate key

→serial in BCNF

customer(name,addr,memberno)

name,addr -> memberno Candidate key

memberno -> name,addr Candidate key

→customer in BCNF

hire(memberno,serial,date)

serial,date -> memberno Candidate key

→hire in BCNF

Therefore, the relations are also now in BCNF.