**10.1** Go back to the relation tables we submitted in week 6 and review them after normalization

1. **PolicyType** (company, policyType, medicalCoPay, labCoPay, pharmacyCoPay)
2. **InsurancePolicy** (policyNo, *company*, insuredName, *policytype*, startDate, endDate)
3. **Zip (**zipCode, city, state);
4. **Patient (**patientNo, firstName, lastName, street, *zipCode*, phone, dateOfBirth, sex, *policyNo*);
5. **Staff** (staffNo, firstName, lastName, title, specialty, street, *zipCode*, phone)
6. **Availability** (*staffNo,* availDate, startTime, endTime)
7. **RoomType** (roomType, condition)
8. **Room** (roomNo, *roomType,* condition)
9. **VisitType** (visitType, visitCost)
10. **Visit** (visitNo, *patientNo,* visitDate, visitTime, duration, reason, *visitType*, *staffNo, roomNo*)
11. **Appointment** (*patientNo, appDate, appTime,* reason, *staffNo, visitNo*)
12. **Referral** (refNo, *visitNo,* refTo, reason)
13. **Bill** (invoiceNo, billDate, totalAmount, dueDate, *patientNo*)
14. **Charge** (*invoiceNo*, serviceType, serviceDate, amountCharged)
15. **Payment** (*invoiceNo*, datePaid, amountPaid*, insurancePolNoPayer)*
16. **Drug** (drugDispensed*, cost*)
17. **TestType** (testType, cost)
18. **DiagnosisMenu** (diagCode, diagName)
19. **ProcedureMenu** (procCode, procName, cost)
20. **PrescriptionScript** (scriptNo, visitNo, dateWritten, Directions)
21. **PrescriptionMedication** (RXNumber, *scriptNo*, drugDispensed, dateDispensed, quantityPrescribed, quantityDispensed, refillsRemaining)
22. **LabTest** (testNo, *RXNumber*, *testType*, testDate, testTime, cost, result)
23. **ProcedurePerformed** (*visitNo*, *procCode*, result)
24. **Diagnosis** (*visitNo, diagCode*, dateOnset, symptoms, severity, prognosis)

**10.2** Wellness Clinic has branched out to four locations: Manhattan, Queens, Brooklyn, and the Bronx. Show how all four end users share the same database.

The applications performed at each branch for that branch’s own data are:

Maintaining patient records

All boroughs:

1. Producing Patient Monthly Statements
2. Producing Individual Practitioner’s Daily Schedule
3. Producing Prescription Label and Receipt Form
4. Producing Operating Room Schedule
5. Maintaining Operating Room Log
6. Maintaining Daily Delivery Room Log
7. Producing Recovery Room Log
8. Producing Monthly Activity Report

Performed at Manhattan only:

1. Producing Daily Laboratory Log
2. Maintaining Daily Master Schedule
3. Producing Weekly Coverage Schedule
4. Producing Insurance Statements

**10.3**

1. Producing Patient Monthly Statements - Patient, Bill, Charge, Payment, PolicyType, Insurance, VisitType, and VisitNo tables
2. Producing Individual Practitioner’s Daily Schedule - Staff, Availability, and Appointment tables
3. Producing Prescription Label and Receipt Form - Drug, PrescriptionScript, PrescriptionMedication, Policy Type, and Insurance tables
4. Producing Operating Room Schedule - Staff, Patient, ProcedurePerformed, ProcedureMenu, and Room tables
5. Maintaining Operating Room Log - Staff, Patient, Diagnosis, DiagnosisMenu, ProcedureMenu, and ProcedurePerformed tables
6. Maintaining Daily Delivery Room Log - Staff, Patient, RoomType, Room, Diagnosis, DiagnosisMenu, ProcedureMenu, and ProcedurePerformed tables
7. Producing Recovery Room Log - Patient, Staff, RoomType, Room, ProcedurePerformed, Diagnosis, Diagnosis Menu, and Referral tables
8. Producing Monthly Activity Report - Patient, Staff, VisitType, Visit, LabTest, and PrescriptionMedication tables

Performed at Manhattan only:

1. Producing Daily Laboratory Log - TestType and LabTest tables
2. Maintaining Daily Master Schedule - Staff and Availability tables
3. Producing Weekly Coverage Schedule - Staff and Availability tables
4. Producing Insurance Statements - Zip, Patient, InsurancePolicy, PolicyType, VisitType, and Visit tables

**10.4**

**Patient**.

PatientFragment1 = ΠPatientNo, firstName, lastName, street, zip, policyNo(Patient).

We only use one fragment and its attributes across all locations because Wellness Clinic’s operations are not divided among the four boroughs of New York City. Hence, all locations carry out the same operations, and Manhattan, exclusively, performs lab tests; manages staff and availability schedules as well as releases insurance statements about patients, insurance policies, and policy type.

We will use the following code to distinguish the branch.

**1 = Manhattan**

**2 = Brooklyn**

**3 = Queens**

**4 = Bronx**

**ZipCode**. Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Staff.** Manhattan uses the entire table for applications 10 and 11. Each branch uses this table for producing the individual practitioner’s daily schedule (2), producing the operating room schedule (4), maintaining the operating room log (5), maintaining the delivery room log (6), producing the recovery room log (7), and for producing the monthly activity report (8). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the staffNo contains a code indicating the branch as follows:

StaffManhattan= σstaffNo LIKE ‘1%’(Staff)

StaffBrooklyn= σstaffNo LIKE ‘2%’(Staff)

StaffQueens= σstaffNo LIKE ‘3%’(Staff)

StaffBronx= σstaffNo LIKE ‘4%’(Staff)

**ProcedureMenu**. Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**ProcedurePerformed**. Each branch uses this table for producing the operating room schedule (4), maintaining the operating room log (5), maintaining the delivery room log (6), and for producing the recovery room log (7). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the visitNo contains a code indicating the branch as follows:

ProcedurePerformedManhattan= σvisitNo LIKE ‘1%’(ProcedureMenu)

ProcedurePerformedBrooklyn= σvisitNo LIKE ‘2%’(ProcedureMenu)

ProcedurePerformedQueens= σvisitNo LIKE ‘3%’(ProcedureMenu)

ProcedurePerformedBronx= σvisitNo LIKE ‘4%’(ProcedureMenu)

**Diagnosis.** Each branch uses this table for maintaining the operating room log (5), for maintaining the delivery room log (6), and for producing the recovery room log (7). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the visitNo contains a code indicating the branch as follows:

DiagnosisManhattan= σvisitNo LIKE ‘1%’(Diagnosis)

DiagnosisBrooklyn= σvisitNo LIKE ‘2%’(Diagnosis)

DiagnosisQueens= σvisitNo LIKE ‘3%’(Diagnosis)

DiagnosisBronx= σvisitNo LIKE ‘4%’(Diagnosis)  
  
**DiagnosisMenu.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Appointment.** Each branch uses this table for producing the individual practitioner’s daily schedule (2). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the visitNo contains a code indicating the branch as follows:

AppointmentManhattan= σvisitNo LIKE ‘1%’(Appointment)

AppointmentBrooklyn= σvisitNo LIKE ‘2%’(Appointment)

AppointmentQueens= σvisitNo LIKE ‘3%’(Appointment)

AppointmentBronx= σvisitNo LIKE ‘4%’(Appointment)

**Bill.** Each branch uses this table for producing the patient monthly statements (1). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the invoiceNo contains a code indicating the branch as follows:

BillManhattan=σinvoiceNo LIKE ‘1%’(Bill)

BillBrooklyn=σinvoiceNo LIKE ‘2%’(Bill)

BillQueens=σinvoiceNo LIKE ‘3%’(Bill)

BillBronx=σinvoiceNo LIKE ‘4%’(Bill)

**Charge.** Each branch uses this table for producing the patient monthly statements (1). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the invoiceNo contains a code indicating the branch as follows:

ChargeManhattan=σinvoiceNo LIKE ‘1%’(Charge)

ChargeManhattan=σinvoiceNo LIKE ‘2%’(Charge)

ChargeManhattan=σinvoiceNo LIKE ‘3%’(Charge)

ChargeManhattan=σinvoiceNo LIKE ‘4%’(Charge)

**​​Payments.** Each branch uses this table for producing the patient monthly statements (1). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the invoiceNo contains a code indicating the branch as follows:

PaymentManhattan=σInvoiceNo LIKE ‘1%’(Payment)

PaymentBrooklyn=σInvoiceNo LIKE ‘2%’(Payment)

PaymentQueens=σInvoiceNo LIKE ‘3%’(Payment)

PaymentBronx=σInvoiceNo LIKE ‘4%’(Payment)

**Availability.** Each branch uses this table for maintaining the daily master schedule (10) and for producing the weekly coverage schedule (11). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the staffNo contains a code indicating the branch as follows:

AvailabilityManhattan=σstaffNo LIKE ‘1%’(Availability)

AvailabilityBrooklyn=σstaffNo LIKE ‘2%’(Availability)

AvailabilityQueens=σstaffNo LIKE ‘3%’(Availability)

AvailabilityBronx=σstaffNo LIKE ‘4%’(Availability)

**RoomType.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Room.** Each branch needs this table to maintain the operating room log (5), to maintain the daily delivery room log (6), and to produce the recovery room log (7). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the roomNo contains a code indicating the branch as follows:

RoomManhattan=σroomNo LIKE ‘1%’(Room)

RoomBrooklyn=σroomNo LIKE ‘2%’(Room)

RoomQueens=σroomNo LIKE ‘3%’(Room)

RoomBronx=σroomNo LIKE ‘4%’(Room)

**VisitType.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Visit.** Each branch needs this table to produce the patient monthly statements (1), to produce the monthly activity report (8) and to produce the insurance statements (12). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the visitNo contains a code indicating the branch as follows:

VisitManhattan=σvisitNo LIKE ‘1%’(Visit)

VisitBrooklyn=σvisitNo LIKE ‘2%’(Visit)

VisitQueens=σvisitNo LIKE ‘3%’(Visit)

VisitBronx=σvisitNo LIKE ‘4%’(Visit)

**Referral.** Each branch uses this table for producing the recovery room log (7). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the referralNo contains a code indicating the branch as follows:

ReferralManhattan=σreferralNo LIKE ‘1%’(Referral)

ReferralBrooklyn=σreferralNo LIKE ‘2%’(Referral)

ReferralQueens=σreferralNo LIKE ‘3%’(Referral)

ReferralBronx=σreferralNo LIKE ‘4%’(Referral)

**Drugs.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**TestType.** All tests are conducted only at the Manhattan branch**.**

**PrescriptionScript.** Each branch uses this table for producing the prescription label and receipt form (3) and for producing the monthly activity report (8). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the scriptNo contains a code indicating the branch as follows:

PrescriptionScriptManhattan=σscriptNO LIKE ‘1%’(PrescriptionScript)

PrescriptionScriptBrooklyn=σscriptNO LIKE ‘2%’(PrescriptionScript)

PrescriptionScripQueens=σscriptNO LIKE ‘3%’(PrescriptionScript)

PrescriptionScriptBronx=σscriptNO LIKE ‘4%’(PrescriptionScript)

**PrescriptionMedication.** Each branch uses this table for producing the prescription label and receipt form (3) and for producing the monthly activity report (8). We can use selection to form horizontal fragments. We can form these using a selection operation, if we assume the RXNumber contains a code indicating the branch as follows:

PrescriptionMedicationManhattan=σRXNunber LIKE ‘1%’(PrescriptionMedication)

PrescriptionMedicationManhattan=σRXNunber LIKE ‘2%’(PrescriptionMedication)

PrescriptionMedicationManhattan=σRXNunber LIKE ‘3%’(PrescriptionMedication)

PrescriptionMedicationManhattan=σRXNunber LIKE ‘4%’(PrescriptionMedication)

**LabTest.** All lab tests are only conducted at the Manhattan branch.

**10.5**

**Patient.** The patient table will be updated very infrequently, and PatientNo and name appear in many applications at all branches. Here we only use one fragment and its attributes across all locations because Wellness Clinic’s operations are not divided among the four boroughs of New York City.

**ZipCode.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Staff.** The staff table will be updated infrequently. The staff usually work at one location, so we divided it into delivered tables for each branch. So, for each branch there will be table for that specific location.

**ProcedurePerformed.** Each branch stores data about its own procedures that was performed, using the ProcedurePerformedManhattan, ProcedurePerformedBrooklyn, ProcedurePerformedQueens,ProcedurePerformedBronx

**ProcedureMenu.** Each branch stores data about its own potential procedures, using the fragments ProcedureMenuManhattan, ProcedureMenuBrooklyn, ProcedureMenuQueens, and ProcedureMenuBronx.

**Diagnosis.** Each branch stores data in regards to its own patients using the DiagnosisManhattan, DiagnosisBrooklyn, DiagnosisQueens, and DiagnosisBronx.

**DiagnosisMenu.** This table is stored at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Bill.** Each branch of the clinic releases bill statements for the different services offered, namely BillManhattan, BillBrooklyn, BillQueens, and BillBronx.

**Charge.** Each branch of the clinic handles charges from customers and insurance providers at all four locations, and the fragments are ChargeManhattan, ChargeBrooklyn, ChargeQueens, and ChargeQueens.

**Appointment.** Each branch stores data in regards to its own patients using the fragments AppointmentManhattan, AppointmentBrooklyn, AppointmentQueens, and AppointmentBronx.

**Drugs.** This table is stored at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Referral.** Each branch provides referrals using the fragments ReferralManhattan, ReferralBrooklyn, ReferralQueens, ReferralBronx.

**VisitType.** This table is stored at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Visit.** This table is available for all the four locations using the fragments VisitManhattan, VisitBrooklyn, VisitQueens, and VisitBronx.

**PrescriptionScript.** PrescriptionScript can be provided at each branch, so we are using the fragments PrescriptionScriptManhattan, PrescriptionScriptBrooklyn, PrescriptionScriptQueens and PrescriptionScriptBronx.

**PrescriptionMedication** Prescription Medication is provided at each branch, so we are using the fragments PrescriptionMedicationManhattan, PrescriptionMedicationBrooklyn, PrescriptionMedicationQueens, and PrescriptionMedicationBronx.

**LabTest.** All lab tests are only conducted at the Manhattan branch.

**10.6**

| Application | Manhattan | Brooklyn | Queens | Bronx |
| --- | --- | --- | --- | --- |
| Producing Patient Monthly Statements | ProcedurePerformedManhattan,  ProcedureMenuManhattan,  PatientFragment1 | ProcedurePerformedBrooklyn,  ProcedureMenuBrooklyn,  PatientFragment1 | ProcedurePerformedQueens,  ProcedureMenuQueens,  PatientFragment1 | ProcedurePerformedBronx,  ProcedureMenuBronx,  PatientFragment1 |
| Producing Individual Practitioner’s Daily Schedule | StaffManhattan,  AvailabilityManhattan,  PatientFragment1 | StaffBrooklyn,  AvailabilityBrooklyn,  PatientFragment1 | StaffQueens,  AvailabilityQueens,  PatientFragment1 | StaffBronx,  AvailabilityBronx,  PatientFragment1 |
| Producing Prescription Label and Receipt Form | StaffManhattan,PrescriptionScriptManhattan, PrescriptionMedicationManhattan,  PatientFragment1 | staffBroomlyn,PrescriptionScriptBrooklyn,PrescriptionMedicationBrooklyn,  PatientFragment1 | staffQueens,  PrescriptionScripQueens, prescriptionMedicationQueens,  PatientFragment1 | staffBronx,  PrescriptionScriptBronx, prescriptionMedicationBronx,  PatientFragment1 |
| Producing Operating Room Schedule | staffManhattan,  PatientFragment1 | staffBrooklyn,  PatientFragment1 | staffQueens,  PatientFragment1 | staffBronx,  PatientFragment1 |
| Maintaining Operating Room Log | staffManhattan,  PatientFragment1 | staffBrooklyn,  PatientFragment1 | staffQueens,  PatientFragment1 | staffBronx,  PatientFragment1 |
| Maintaining Daily Delivery Room Log | ProcedurePerformedManhattan,  PatientFragment1 | ProcedurePerformedBrooklyn,  PatientFragment1 | ProcedurePerformedQueens,  PatientFragment1 | ProcedurePerformedBronx,  PatientFragment1 |
| Producing Recovery Room Log | RoomManhattan,  PatientFragment1 | RoomBrooklyn,  PatientFragment1 | RoomQueens,  PatientFragment1 | RoomBronx,  PatientFragment1 |
| Producing Monthly Activity Report | StaffManhattan,  PatientFragment1 | StaffBrooklyn,  PatientFragment1 | StaffQueens,  PatientFragment1 | StaffBronx,  PatientFragment1 |
| Producing Daily Laboratory Log | staffManhattan, LabTest, TestType,  PatientFragment1 | staffBrooklyn, LabTest, TestType,  PatientFragment1 | staffQueens, LabTest, TestType,  PatientFragment1 | staffBronx, LabTest, TestType,  PatientFragment1 |
| Maintaining Daily Master Schedule | StaffManhattan,  AvailabilityManhattan,  PatientFragment1 | StaffBrooklyn,  AvailabilityBrooklyn,  PatientFragment1 | StaffQueens,  AvailabilityQueens,  PatientFragment1 | StaffBronx,  AvailabilityBronx,  PatientFragment1 |
| Producing Weekly Coverage Schedule | StaffManhattan,  PatientFragment1 | StaffBrooklyn,  PatientFragment1 | StaffQueens,  PatientFragment1 | StaffBronx,  PatientFragment1 |
| Producing Insurance Statements | BillManhattan,  ChargeManhattan,  PatientFragment1 | BillBrooklyn,  ChargeBrooklyn,  PatientFragment1 | BillQueens,  ChargeQueens,  PatientFragment1 | BillBronx,  ChargeBronx,  PatientFragment1 |

10.7

| Application | Manhattan | Brooklyn | Queens | Bronx |
| --- | --- | --- | --- | --- |
| Producing Patient Monthly Statements | Local | Local | Local | Local |
| Producing Individual Practitioner’s Daily Schedule | Local | Local | Local | Local |
| Producing Prescription Label and Receipt Form | Local | Local | Local | Local |
| Producing Operating Room Schedule | Local | Local | Local | Local |
| Maintaining Operating Room Log | Local | Local | Local | Local |
| Maintaining Daily Delivery Room Log | Local | Local | Local | Local |
| Producing Recovery Room Log | Local | Local | Local | Local |
| Producing Monthly Activity Report | Local | Local | Local | Local |
| Producing Daily Laboratory Log | Local | Remote | Remote | Remote |
| Maintaining Daily Master Schedule | Local | Remote | Remote | Remote |
| Producing Weekly Coverage Schedule | Local | Remote | Remote | Remote |
| Producing Insurance Statements | Local | Remote | Remote | Remote |

**10.8**

The applications requiring remote access are daily lab logs, maintaining daily masters schedule, and producing insurance statements. All these are created and handled by Manhattan. All other branches have to access the Manhattan location in order to carry out lab tests and other test types for patients. The traffic will be based on the number of lab tests which we predict will be a traffic level of medium. The daily master schedule and weekly coverage schedule will produce the time slots for the staff. For this reason Manhattan will produce this schedule and other locations will have access to it with a level of traffic of low. Insurance statements will be handled by Manhattan with Brooklyn, Queens, and the Bronx having remote access to it. This will have a high level of traffic due to the daily operations of the clinics.

**10.9**

Since most accesses are local, there is no need to adjust the geographical network shown in Figure 10.2