Scenarios for practicing modelling techniques

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Contents

1. Introduction

This document provides details of a number of scenarios which are referred to in the modelling material at:

http://www.robin-beaumont.co.uk/virtualclassroom/contents.htm

2. Sheltered Workshop

The sheltered workshop provides a supportive environment for those with mental health or learning disability problems in which to work. The clients are referred by GPs or any other member of the community healthcare team. Courses are available for those wishing to gain a qualification (NVQ levels). The workshop also runs basic numeracy and literacy courses.

There are five sections of the workshop: woodwork, metal work, upholstery, gardening and IT. Clients can choose to work any number of half-day sessions in any of the sections providing there is a vacancy and they are suitable.

The client is initially assessed by a care manager, or one of his/her assistants, after which a programme of care with regular reviews is implemented. The programme of care might include a number of different work sessions and enrolment into one or more courses.

Clients are paid for by the local Health authority, donations and the Council for those referred by social services.

A number of trips are organised each season; however, not all clients attend each as some are considered unsuitable due to previous performance or antisocial behaviour etc. Clients regularly fill in satisfaction questionnaires, and each section is partly judged on this as well as profit (the workshop has a shop and several retail outlets). The workshop also has a website, which is basically an online catalogue. Customers cannot place orders over the web, and there is no intention of them being able to do so in the future.

The aim is to gradually get clients to move from the workshop into real employment, but unfortunately this happens in less than 50% of cases. Where it does happen, long term follow up support is provided by the case manager and his/her team.

While in the workshop, any critical incidents involving a client are recorded by the key worker, of which there are several working in each of the sections. Each section also has a designated manager who is a particular key worker appointed on a rotation basis.

3. Domestics / Handyman agency

A local entrepreneur has set up a Domestics / handyman agency. He already has approximately 100 domestics and odd job personnel.

The business is growing for several reasons. Recently a number of university students have contacted the agency to offer themselves at reduced rates of pay. Also the local social service department has asked if the agency can take on basic domestic work for a number of clients which would have been traditionally carried out by 'home helps'. The agency has accepted both offers.

Each person who joins the agency selects from a number of services they can offer, along with availability and preferences.

Once a person joins the agency they will be allocated to one or more jobs which occur at specific times. The jobs are allocated on a two weekly basis by one of three supervisors. However a particular employee can book jobs any time in advance.

The entrepreneur wishes to develop a more professional relationship with his clients, particularly now that he is moving into the social services arena. Therefore he plans on distributing to all the clients, on a regular basis, satisfaction questionnaires. He wants to use the results of such feedback to enhance the domestics service to cater more to the social service requirements and possibly offer optional enhancements for those who can pay. He is also interested in linking the results to employee performance but not quite certain how this can be done, with the possibility of several employees over the course of time carrying out the task for a particular client.

One stipulation that the social services department has made is that for each visit a domestic makes he/she records the fact that the client was 'well' or if they needed to contact either Social services or another health care worker (i.e. GP and /or nurse). The social services department plan to provide all the necessary contact information to the agency in paper format and are willing to pay for secretarial support to enter the data into the records of the appropriate clients.

4. A GP Practice

A particular GP has been keen to have a computer system to record details of his and his colleagues consultations, who happens to be his wife. He has contacted various GP systems suppliers but can't really afford the expenditure. However two events have occurred to make him reconsider this. He was given a fairly powerful computer (an old server) and two desktop machines, from a patient who's business has gone bankrupt. Coincidentally, his nephew (who is just starting a PhD in computer science) is moving to the local university and has offered to write him a system over the next 5 years.

His practice consists of him and his wife, a part-time nurse and a physiotherapist. Occasional locums cover during holiday periods. A patient can only be registered with one doctor but can be seen by any one (either of the doctors, the nurse or the physiotherapist). Both doctors, the nurse and physiotherapist have been on a clinical methods course which has taught then how to use the 'SOAP' method [White K L evaluation and medicine 1982. In: Evaluation in Health Care. Ed. Holland, W Oxford. Oxford University Press]. This involves recording the following aspects or each visit:

- Subjective – the reason the patient perceives for the consultation – 'RFE (reason for encounter)'
- Objective - Any signs that you find that are important in forming a diagnosis
- Assessment – Diagnosis
- Plan – tests, prescriptions, in fact any action

Both the doctors are very interested in monitoring various problems such as Leg ulcers and Depression and for this purpose have developed a mutually agreed list of 'problems which would be a category in addition to the above. Each problem with then be evaluated at each visit noting if it has improved, got worse, stabilised or resolved.

One of the doctors has been on a pharmacological nutrition course and is eager to reduce the prescribing of certain traditional drugs by the introduction of dietary modifications. The doctor hopes that he will be able to publish a paper on his findings in the future., highlighting the cost savings in drugs.

The receptionist has been with the practice for over twenty years and does not want to use computers, therefore electronically recording of appointments is not required. In contrast the nurse is undertaking an advanced diploma in clinical practice and has an interest in Diabetic patients. She does not know how a computer might help her but would like to be able to see how well her diabetic patients are doing such as being able to see what the average blood sugar was or, number of Hypos per patient over the last month were.

5. Local community Radio station (fictitious)

A community college has secured funds to run a local radio station called WEB (West End Broadcasting) for approximately one month per year. The administrator in charge of the venture wishes to collect information for a variety of reasons:

- Contact list of various types of people for the next season
- Billing and expenditure
- Activities, including listings for each programme
- Studio booking
- Equipment booking

The radio station has a core staff of four: a producer/director, manager, recording engineer (part time) and a secretary. Each of these people can play a number of different roles (eg the secretary may be a presenter for a programme). Besides these staff, a large number of volunteers take part in the day to day running of the station. Some are purely voluntary while others are paid an honorarium. Examples of such staff are sound recording technicians and editors (mostly students).

The actual programs themselves are focused within the community, being presented by local people themselves. For example, a person with a particular interest in Victorian music might present a program about it. The local schools and hospitals are also closely involved in the project with slots for various features.

A presenter (many of these are voluntary) can present several programmes each of which will consist of several items. The items may be recorded in any sequence. For example, a story about a successful local business may be recorded on location before other items in the programme. Each program will be of a particular type (music, local news, lifestyle, etc.). Similarly a sound technician may record the initial item and then may, or may not, pass it on to an editor. Editors always work at the programme level; however, if the programme is going to be 'live' (ie one or more items in it are live), then the editor will produce the pre-recorded component to the programme and may hand that over to another editor for integration into the live component. A single item may be used by several programmes. The final list of items that are broadcast for a programme become the play list for the programme.

There is also an information feedback mechanism. This consists of an email and answer phone facility. Both forms of communication are logged keeping details such as programme name, comment code (good, bad, etc) and a summary of the response sent back. Volunteers take care of this function.

There are six recording studios—all identical, except that studio 1 is the one that is used for live broadcasting. Any equipment can be shared among the various studios. Equipment movement is very common as additional microphones, etc might be needed at any time in a particular studio. Each piece of equipment has a unique code.

6. Personnel system for a Research department

An institute within a University has been established solely for the purpose of Health research. Within this institute there are several departments (Epidemiology, Community and Hospital).

The majority of staff within the institute are purely research project funded the exception being three Professors who have open-ended university appointments. Each member of staff has a designated supervisor who is also a member of the institute.

Each member of staff is designated a particular desk. Several staff may share a office of which the institute has approximately 20. However in the near future the institute is hoping to expand to another floor with an additional 11 offices.

Each member of staff can have one or more cars registered for one parking space. It is part of university policy to have annual formal staff appraisals details of which must be kept.

The research funded staff all possess a fixed term contract that cannot exceed in total cost the amount of funding they have secured from various research projects. Because grants are often small it is necessary for several research staff to share a number of projects, or for one to work on several projects.

The institute has a bank of specialist equipment (i.e. extra laptops for interviewing, Mini-disks for interviewing etc.) A single member of staff can borrow each piece of equipment for a set period.

The institute wishes to continually assess academic performance by carefully monitoring the publications of each member of the research staff. Frequently a publication is a joint authorship between several members of staff. It is expected that each member of the research staff will produce at least two publications a year. This does not apply to the 'administrative' research support staff.

7. Pharmacist Agency

A community pharmacist has established a locum agency, which provides professional cover for community pharmacists.

The locum agency provides a list of the names and addresses of all community pharmacists and also those pharmacists able to provide locum cover within the area.

The agency operates in the following manner:

1. A pharmacist registers with the locum agency on an annual basis.

2. The agency takes a percentage of any salary.

3. Pharmacists inform the agency of those periods when they are able to work. This includes:

   - Time of week available

   - Specific times of the day (or night if it is a 24-hour pharmacy) when available

   - Distances they are prepared to travel

   - Specific places where they will work

   - Specific places where they will not work

4. Community pharmacists requiring locum 'cover' stipulate the following:

   - Periods of service in which they require cover

   - Rates of pay (ie bank holidays, evening rate, etc)

5. The community pharmacist pays the fees/charge directly to the agency and not to the locum pharmacist.

6. The agency pays a percentage of the fees/charge to the locum pharmacist, keeping a percentage for itself for administration charges, etc.

7. The locum pharmacist negotiates an individual rate of pay with the agency.

8. The proprietary pharmacist negotiates the cost of cover with the locum agency, per hour or per day, etc.

The agency has been successful with respect to recruitment, such that a database is required to handle this volume of data.

The agency is advertised in all local community pharmacies, where owners (proprietary pharmacists) may contact the agency when they require locum 'cover'. This may include bank holiday periods, maternity leave, etc. Those pharmacists who often employ locum pharmacists, and therefore regularly use the services of the agency, are entitled to a discount rate.

The information collected should determine those periods requiring regular locum cover—eg bank holidays, Christmas, summer school holidays, etc. From this information the agency would wish to be able to target specific customers with respect to their services.

Provided by Dr Alan Worsley, Sunderland University

8. Environmental Health Inspector

A fictitious local authority's environmental health department is considering updating its computer system. At the moment it uses Microsoft Office products and wants to introduce a system that can record details about its contacts with various businesses and members of the public. The authority wants to use the system to:

1. Keep records of commercial and non-commercial properties that can be updated with new information

2. Prepare standard letters and Notices under environmental health legislation

3. Schedule regular visits and revisits to properties

4. Allocate work to staff

5. Alert employees to particular hazards such as aggressive individuals

6. Store electronic versions of letters or forms received from people as a readily accessible alternative to paper files

7. Monitor the time its employees spend on different types of work with a view to being able to more effectively cost the service

The department employs environmental health officers (EHO's), student EHO's, technical officers (TO's), Dog Wardens, Pest Control Officers, administrative staff and a small team of scientific officers (SO's). Team Leaders (who are also EHO's) manage EHO's, the Dog Wardens and the Pest Control Officers. The Team Leaders are also responsible for allocating work to other employees and setting work priorities. The EHO's manage and allocate work to the TO's and SO's. EHO's are obliged to keep abreast of new developments by keeping a training record. The Team Leaders must ensure that each EHO receives 20 hours of training courses each year. Failure to do so will result in the EHO losing membership of the Chartered Institute of Environmental Health, and it is a condition of their employment that they are members of the CIEH. The Team Leaders are also responsible for ensuring that undergraduate student EHO's receive ample experience of all areas of environmental health work.

There are four main areas of activity in the department with different teams for each. These are health and safety at work, pollution control, food safety, and housing. The department also runs and manages a pest control and dog warden service which is separate to the four teams but which can be used to support work they do as and when necessary. Each area of work is very different in content, but there are similarities.

Each area has responsibility to inspect a set number or percentage of the premises for which it is responsible. Central government or local councillors set targets for the number and/or frequency of properties to be inspected. Information obtained from previous inspections or complaints determines the risk rating of the properties to be inspected. Properties that pose a greater risk to environmental health are scheduled for more frequent inspections. Different types of properties use different criteria to determine their risk rating. For example, the government insists that the food safety team must inspect 100% of its high-risk food premises twice a year, while the councillors have decided that the housing team must inspect the "riskiest" 100 of its bed and breakfast hostels. Properties are allocated to individual EHO's or TO's to inspect and then pursue the most appropriate course of action. Details of every type of action undertaken in connection with the property must be recorded. This includes letters, emails, telephone conversations, meetings, visits, revisits, statutory notices served, court appearances etc. The Team Leaders want to be able to scan all documents received and store them so that each officer can view a list of documents associated with a property.

In addition to the contacts described above the department also receives thousands of complaints from the public about a wide variety of issues. Information about the complainant must be stored along with details of the complaint itself. The admin team receive most of the complaints, which are then passed to the Team Leader of the area responsible for investigating that type of complaint. Many, but not all, of the complaints relate to individual commercial or domestic properties. Some complaints are more general eg. rats sighted on an area of land. The Team Leaders allocate complaints to individual EHO's, TO's or SO's. The officer investigates each complaint, again keeping full records of every action associated with that complaint.

Provided by Paul Gray Sunderland PCT

Hint when developing a UML Sequence Diagram for the scenario: Remember a Sequence Diagram models instances which are represented in one or more class diagrams. Therefore consider a typical fictitious contact (instance 039456 of complaint) such as a rat infestation (value of attribute, description of complaint) at 27 Station Cottages (Instance of location), reported by Miss Daisy Mitford (instance of complainant) who is a 75 year old widow (attributes of complainant), Miss Jones (instance of admin) receives the complaint and creates a instance of client_record (jones_01_012007) etc ".

9. Hospital

We wish to develop a information system for our hospital in which:

"Patients are treated in possibly more than one ward by the doctors assigned to them. Usually each patient will be assigned a single doctor, but in rare cases they will have two. Patients either pay for their treatment directly or through an insurance company.

Heathcare assistants also attend to the patients, a number of these are associated with each ward.

Initially the system will be concerned solely with drug treatment. Each patient is required to take a variety of drugs a certain number of times per day and for varying lengths of time.

The system must record details concerning patient treatment and staff payment. Some staff are paid part time and doctors and care assistants work varying amounts of overtime at varying rates (subject to grade).

The system will also need to track what treatments are required for which patients and when and it should be capable of calculating the cost of treatment per week for each patient.

When the user uses the system they will be able to print out as well as view on screen the results. (though it is currently unclear to what use this information will be put). "

(taken from http://www.umsl.edu/~sauter/analysis/er/er_intro.html and expanded)

10. DopeHead

The DopeHead Testing Corporation undertakes a range of athletics drug tests on behalf of a number of national and international organisations such as the Marathon Club, and the British Indoor Athletics Society. The DopeHead drug testing laboratory, situated in Kensington, receives an average of about 50 blood Samples every day, usually delivered by motor cycle courier. These blood samples are taken and recorded by official duty toxicologists (pharmacists with a PhD or medical doctors) who supervise the random drug testing of athletes at various professional athletics events around the country. The types of events dealt with by the DopeHead Testing Corporation are of three types: Ad hoc professional events, International meetings and British Indoor Athletics Society events. DopeHead does not monitor amateur races.

Once a blood sample has been received by the DopeHead Testing laboratory, it is handed over to a DopeHead Testing laboratory technician, who then becomes responsible for dealing with the blood sample throughout its time in the laboratory. The aim, of the laboratory technician is to discover whether the (blood) sample contains any proscribed chemical substances. Study of a blood sample may yield a number of findings for the presence of different substances in the blood sample. The study of the (blood) sample consists of it undergoing zero (it may be unsuitable for any test) or more tests. Each test examines the sample for one or more proscribed substances. Because the laboratory technician may choose several tests and each test may include the search for a non unique set of proscribed substances (for example general test A and general test B might both test for decadurabolin while each also checking for other proscribed substances which are not common to both tests) there is a possibility that zero or more proscribed substances may have more than a single result (i.e finding), but obviously eachfinding will relate to a specific test. If a laboratory technician finds a positive result for the presence of a proscribed substance in the blood sample, then the amount of each substance found in the sample must be recorded, in milligrams of substance per millilitre of blood. In cases where more than one finding has been obtained for a substance all are reported. In all cases, where a positive finding is recorded for a substance in a blood sample, this finding must be confirmed by the supervisor of the laboratory technician in question. The supervisor is also a laboratory technician. The substances that DopeHead testing deals with are broadly categorised into three classes Stimulants, anabolic steroids, and Analgesics.

Two major complications in the task performed by the DopeHead Testing laboratory exist. Firstly, certain substances are banned by some organisations and allowed by others. The analgesic "Lothariol", for example, is banned by the Athletics Club of Great Britain, but allowed by the American javelin throwers Club. Secondly some substances are only banned by some organisations if found in blood at a greater concentration than some fixed figure. For example, the stimulant "Methacylcrate" is illegal in British Indoor Athletics Society events only if present at a level greater than 110mg per ml of blood because a certain amount of this substance is produced naturally when exercising. The investigation of other legal substances within the sample that may have produced a false positive result is not investigated by the DopeHead Testing Corporation.

In order to take part in any official professional athletics event, an athlete must be registered with the organisation that is supervising that event. Because of the increasing internationalisation of Athletics, athletes may be registered with a number of different organisations (e g. the British and American Sprinters Clubs). In order to detect cheating through drug misuse DopeHead Testing needs to use this kind of information. Throughout an athletes competitive life, they may take part in a number of different events, each of which is under the supervision of a different professional organisation. A athlete may also have been subject to random drug sampling in one or more of these events, where the toxicologist will extract a blood sample to send to DopeHeads Testing's laboratory. In order to detect patterns of cheating via the misuse of drugs over time, DopeHead also needs to know the official registered sponsor for each athlete (athletes have been known to change name) as well as the "trainer" (the person who has day to day responsibility for supervision).

1.1. Longitudinal report

Athleteid	Surname	Age (yrs) at time of report
B27483	Gossling	23

Sample			Taken by		
ID	**Date**	**Received**	**Toxicologist ID**	**Surname**	**Tel**
220148	10/12/2000	11/12/2000	T1288	Mason	0191 4652211
Event	**Type**	**Start date**			
Gateshead autumn	1 day National	08/12/2000	Findings		
			Substanceid	Description	Amount
			S1004	Alguzol	130
			S4002	Stanburin	005
			S1009	Clenbutol	010

Sample			Taken by		
ID	**Date**	**Received**	**Toxicologist ID**	**Surname**	**Tel**
220003	09/08/2000	09/08/2000	T1003	Wallace	0136 2864521
Event	**Type**	**Start date**			
Olympia	3 day international	09/08/2000	Findings		
			Substanceid	Description	Amount
			S1004	Alguzol	100

Sample			Taken by		
ID	**Date**	**Received**	**Toxicologist ID**	**Surname**	**Tel**
210948	14/08/1999	14/08/1999	T1003	Wallace	0136 2864521
Event	**Type**	**Start date**			
Olympia	3 day international	12/08/1999	Findings		
			Substanceid	Description	Amount
			S4001	Lothariol	005
			S4003	Stanburin-B	010

1.2. Specified Sample Report

Sample:					
ID	Date (taken)	Received	Toxicologist ID	Surname	Tel
210948	14/08/1999	14/08/1999	T1003	Wallace	0136 2864521
Received by:					
Id	Surname	email			
T221	Smith	asmith@dopehead.com			

Test:					
No	Description	Technician ID	Techn. Surname	Supervisor Surname	Techn. Email
ST205	Steriod screening	T1003	Kowal	Smith	AKowal@dopehead.com
			Findings:		
			Substanceid	Description	Amount
			S4001	Lothariol	005
			S4003	Stanburin-B	010

Sample:					
ID	Date	Received	Toxicologist ID	Surname	Tel
220148	10/12/2000	11/12/2000	T1288	Mason	0191 4652211
Received by:					
Id	Surname	email			
T226	Clarke	DClarke@dopehead.com			

Test:					
No	Description	Technician ID	Techn. Surname	Supervisor Surname	Techn. Email
RT116	Rausch test	T1001	Rodgers	Smith	PRodgers@dopehead.com
			Findings:		
			Substanceid	Description	Amount
			S1004	Alguzol	130
			S1009	Clenbutol	010

1.3.   Fields

The following is a selection of data items / attributes from the Dopehead Testing Corporation database.

Name	Description
TrainerSurName	The surname of the trainer
TrainerNo	The identification number of a trainer
AthletesSurname	The surname of a athlete
AthletesID	The value used by Dopehead it identify a athlete
AthleteDOB	The date of birth of a athlete
Eventname	The name of an event in which an athlete competes
Eventtype	The type of event
Eventstart	The start date of an event
Eventcontactsurname	The surname of the person responsible for a particular event
EventContactNo	The telephone number of the person responsible for an event
ToxicolID	The value used by Dopehead to identify a particular toxicologist
Toxicolsurname	The surname of a particular toxicologist
ToxicolTel	The telephone number of a particular toxicologist
SampleNo	The identifier of a sample
SampleDate	The date on which a sample was taken
SampleReceived	The date on which a sample was received by Dopehead
TestNo	A value identifying a particular test
TestDate	The date when a particular test was undertaken
Technicianid	A value identifying a particular technician
Grade	The grade of a technician
Salary	The salary of a technician
Email	The email contact of a technician
Supervisor	The value identifying a particular technician who possesses a suitable grade to b a supervisor
SubstanceName	The name of a chemical substance
SubstanceType	The type of substance
SubstabceId	Identification number of a substance
SubstanceLimit	The permissable lower limit for a substance found in a blood sample (mg per ml)

11. MasterPlumbers Ltd

MasterPlumbers Ltd is a firm with two offices almost 25 miles apart, one based in Newtown and the other at Sunnyport. The company specialises in large industrial plumbing projects and over the last seven years has built up a strong local presence known for its reliability and ability to complete projects on time and within budget.

At any one time the team of Project Managers (PMs), overseen by the sole Managing Director (MD), are managing zero or more projects. A PM may manage more than one project. Occasionally the PMs are on courses or not performing their usual roles for several reasons. A project may be managed by more than one PM, but each project will have a 'lead' manager. The firm has good links with local colleges and universities and provides placements for students on various courses ranging from secretarial and management to plumbing and plastering. A student is always allocated to a specific employee. Because the company is expanding and the PMs have recently felt that they are isolated, the MD has devised a buddy system where several PMs take turns being team leaders, this basically entails supporting the others in the team. As part of the company's quality assurance plan they keep full records about this aspect of the firm as well as each employee's training history, planned courses and students they have supervised. The company receives payment for taking on students so it is considered to be a small money earner, in contrast to the often very expensive courses the PMs attend.

Each project has a schedule consisting of a list of items, each of which consists of a number of tasks (i.e. if the company is refurbishing a hotel, one item may be a list of tasks necessary to plumb the first floor, another item might be the works necessary to plumb the kitchen, another being the staffs quarters etc). For any Task there are at least two aspects concerning costing, the actual cost to the company and that seen by the client. The list of Tasks provides one aspect of the projected project cost (PPC) which is the cost that the purchaser of MasterPlumbers services sees on the bill; it is not the actual cost incurred by the company for carrying out the work.

Rather strangely to the outsider, the PPC also includes an amount that the firm does not expect to recover. This amount can be divided into three types:

- **Retention cost** (RC)– The person/company who has agreed a contract with MasterPlumbers Ltd only pays this fee after the project has undergone a review by an independent architect at a specified date in the future (usually one year after the project has been completed). The PM at MasterPlumbers manages this process. The actual cost can be either a percentage of the PPC or an agreed amount. In some projects there is no retention cost.

- **Defects liability** (DL)– This amount is only paid to MasterPlumbers after a specified period if no defects have been reported. The amount and time period can vary depending upon the contract. How this process is managed appears rather haphazard, and the various PMs interviewed seem to give different, conflicting accounts.

- **MCD** (Main Contractors' Discount) – Some companies/individuals who use MasterPlumbers are given a discount on the bill. You could call this a loyalty or sale discount. This amount is never recouped by MasterPlumbers.

In addition to the above three there is also a Standard cost which forms the bulk of most PPC's. This is derived from a number of expenses, discussed below and the Items, from the project

Besides the Project Schedule there is also a Project Account which maintains information about Income (i.e. bills paid/receipts in other words the PPC), Expenditure (costs) and coordinates the Billing Schedule. The Project Account therefore contains information that is available to the customer, by way of the Billing Schedule and the PPC, and also more detailed information that is not available to the customer. The more detailed information is collected from a number of Expenses (see below) and also the firm's main accounting system, with which the Project account also provides it information as well as querying it.

A Billing Schedule is required because the projects are large, and several bills are expected during the project. Each bill (also called a receipt invoice) may be an overall percentage of the total work completed or a list of completed items or even a set of percentages of partially completed items from the schedule. Depending upon the agreement with MasterPlumbers, VAT (a specific tax) will be included in each bill or just the final bill. The final bill is sent when all the items on the schedule are completed; this is not the same bill as the Retention / Defects bills as described above. The project is only considered to be completed once both the final bill and the Retention / Defects bills are fully paid. Notice that here the MCD is not classed as income but as a cost to the company.

For any project, MasterPlumbers has a range of costs (expenses) such as the services of sub-contractors (electricians, tilers etc.), materials, shared overheads such as human resourcing (i.e. the PMs' and MD's time as well as other factors mentioned above), electricity, rent and administrative costs. Usually this information is not disclosed to those who make use of the MasterPlumbers services but is carefully monitored within the company by the PMs and the MD. Regular reports are produced to see the profit (sales [i.e. PPC] less expenses) for each completed project, and the projected profit for those projects currently being undertaken. Similar reports are produced to see which PM has generated the most profit.

The above monitoring process, along with other factors, means that the cost of a project may change while the project progresses. This is achieved by creating a 'variance order'. This is an additional bill which can be either positive (increasing the cost to the client) or negative (reducing the amount). One such type of variance order is the addition of an extra item to the schedule during the project. This is not the same as adding an additional expense (e.g. replacing a piece of defective equipment) which is hidden from the customer and absorbed in the PPC.

The firms main accountancy system also keeps details of each employees / students finances, including salaries, bursaries, expenses incurred etc.

An innovative employee has recently set up an intranet which is used to post relevant company / professional information, as well as advertising social events across the two offices.

Hints:

When developing a UML Sequence Diagram for the scenario: Remember a Sequence Diagram models instances which are represented in one or more class (or ERD) diagrams. Therefore consider a typical project, say project number 2934, based upon the information given plus additional assumptions made by you to allow you to create appropriate instances of the various classes you identify.

When developing a UML Class Diagram for the scenario: To help you organise your thoughts consider grouping the various Classes you identify into a number of subject areas. Remember you are trying to organise the information about the company at a high level, that is into classes or entity types. So do not consider how many databases there might be and of what type (i.e. project management, web based etc). In my model answers I have a range of classes from around 19 to about 3o depending upon how I have modelled the subtypes.

12. Microbiology Laboratory

During the course of admission, a number of specimens may be collected from a patient for the diagnosis of infection and sent to a microbiology laboratory. Each of these specimens is regarded by the laboratory as a request for one or more tests, and in most cases several different tests will be required, such as microscopy, culture, organism identification, and antibiotic sensitivity testing. All these tests must be carried out by biomedical scientists (BMS) and the results recorded before the final report is authorised and the report released to the clinician.

Each specimen will have microscopy performed on it and for the sake of simplicity in this scenario we may consider this to be one test (although in practice it may itself consist of several sub-tests).

Each specimen will be cultured and the result may be no growth (i.e. no organism isolated) or the growth of one or more organisms. If there is a positive culture result, each organism will be identified and have antibiotic sensitivity tests performed on it. Again, for simplicity we will assume that identification consists of one test, so that each organism has one identification test associated with it, but that one or more antibiotics will be tested against each organism.

Once the culture (and organism identification and sensitivity tests, if appropriate) are complete, the report is checked and authorised by a supervising BMS, before being made available to the clinical staff. The results of all the various tests are stored in a large computer database which can be accessed in order to look up the complete result on any specimen.

Your task is to design the model which will enable a database structure to be created to hold the various items of data as efficiently as possible. Note that for audit purposes the identity of the BMS who performed each test must be recorded, so this must be included in the model. You need not worry about specimen collection; assume the process starts with the arrival of the specimen in the laboratory and ends with final report authorisation. You need to think about the different Classes which will be included in your database and how they relate to the other Classes. There is no need to include full details of all the data items each Class must contain, just a few for each Class will do.

For those who do not work in a laboratory, you should note that the above description is considerably simplified; it assumes that all organisms will be identified and tested for antibiotic sensitivity, which is certainly not the case, and that there is a fixed series of tests which are applied to each specimen. Often these vary from one specimen to another, and laboratory medical staff may add (or delete) individual tests to a specimen at any time, even after the final report is produced! Also, each 'test' – e.g. culture – may be broken down into individual sub-tests such as the individual culture plates used, of which there may be several. In many laboratories some specimens are also checked – and may be modified – by a member of the laboratory medical staff before final release to the clinician.

Kindly supplied by Steve Pedler Consultant Microbiologist.

13. Exam System for the Royal College of Colonic Irrigationists (RCCI)

Fictitious.

Several factors help explain the formation of this unique college, including the recent discovery of indisputable clinical evidence (based upon several multi-centre RCT's) demonstrating the effectiveness of many of the procedures associated with Colonic Irrigation. Additionally the Royal family and several eminent medical stakeholders / politicians, including Council members and Presidents of other Medical Royal Colleges, felt that the formation of a new college would be appropriate.

The Royal College of Colonic Irrigationists (RCCI) has over 2,000 members worldwide who are of various types including fellows, associates and students. The 'persons' database at the RCCI keeps mailing, membership and status (fellow, associate, student etc) details. The RCCI now wishes to develop an examination system. To help with the planning process they have provided the following information.

Because an examination candidate need not necessarily be on the 'persons' database to be eligible to take one of the college examinations, the RCCI keep a list of candidates at any time. At present there are 3 exams although the college wishes to expand the number and type of exams in future.

Each of the three exams consists of one or more assessments:

- MRCCI Part a – MCQ (Multiple Choice Questions)

- MRCCI Part b – two parts (OSCE and written)

- FRCCI – four parts (OSCE, written, clinical management viva and several critical appraisals)

The OSCE (Objective Structured Clinical Examination) consists of one or more (usually around 10 - 15) planned clinical encounters ('stations') in which one or more examiners present a candidate with a particular patient or specimen or investigation result for discussion. (See http://www.kmrrec.org/KM/osce/ for details). A single examiner may move around several stations (see the sample report).

A particular assessment may or may not be re-sat depending on the results of the specific assessment or the other associated assessments, and the re-sit may involve all of the assessments or a specific assessment. Because of the complexity of this process it is envisaged that while the actual result will be kept electronically, the decision of who is eligible to re-sit a particular assessment will be made manually. Once a candidate has passed all of the necessary assessments they are added to the 'persons' database with the appropriate information

The RCCI keep a pool of examiners with details of which assessment they are capable of assessing along with their status (e.g. external examiner, OSCE examiner, all MRCCI Part b assessments etc.) and qualifications. Before a prospective examiner is able to practice they must undergo a specific training course run by the RCCI. Additionally, they must attend refresher courses regularly. Some examiners have additional specific duties such as reviewing exam papers, MCQs and devising OSCEs. The college also keeps regular peer review details of each examiner where they are observed in operation such as carrying out an OSCE. At present all this information is kept in a training record folder for each examiner.

For a specific candidate for a specific assessment, zero or more summary results exist. Also for a specific candidate for a specific assessment, one of these summary results will be tagged as the 'final' mark for each assessment. Because this is providing high level data recording at the assessment level there is at present no marking scheme linked to these results (comments sufficient) however this will hopefully change in future.

In contrast, for each assessment there often exists zero or more detailed marking schemes, providing a detailed explanation to a specific set of raw marks. A detailed marking scheme might well exist without any detailed sets of marks associated with it as similarly a set of detailed marks may not be linked to a detailed marking scheme.

Scheduling

For any particular assessment, one or more examiners may be involved. It is important to know on any exam day exactly who should be attending (both candidates and examiners).

For the OSCE a particularly complex situation exists. One or more examiners are allocated to a particular station (which is at a particular venue) for a number of sessions which might be discontiguous. Similarly the candidates are allocated a time to attend each of the stations. Each station has a marking scheme associated with it which is filled in by each of the examiners. They also fill in a single additional form (which might be of the same design or different) representing the agreed set of marks for the particular student for that particular OSCE.

Selection of reports

Below is a small selection from over 50 that the RCCI would like to be able to produce from the proposed exam system.

Candidate report for GMC number 5647389 (only pass dates shown in this report)

GMC no	Surname	Date Of Birth	MRCCI part1 (date)	MRCCI part2 (date)	FRCCI (date)
5647389	Baguley	21/09/1970	23/12/1991	14/02/1995	

Assessment / candidate report for GMC number 5647389

Assessment ID	Assessment type	Assessment no	date	venue	Start time	End time
091019943	OSCE (MRCCI part b)	9410007	09/10/1994	Green Square	09:15	13:00
200619943	OSCE (MRCCI part b)	9406041	20/06/1994	Station Road	09:15	13:00
021019932	Written (MRCCI part b)	9301050	02/01/1993	Green Square	14:00	17:00
231019911	MCQ (MRCCI part a)	9110003	23/10/1991	Green Square	09:30	12:30
130619911	MCQ (MRCCI part a)	9106045	13/06/1991	Station Road	09:30	12:30
020119911	MCQ (MRCCI part a)	9101057	02/01/1991	Green Square	14:00	17:00

Summary results report for GMC number 5647389 for written paper (MRCCI part b) taken on 02/01/1993

Date mark obtained	grade	percentage	comment	Pass / fail	status	Final result	Marking scheme
25/01/1993	B+	68		p	External mark	no	405
29/01/1993	B+	60	Rushed	p	Internal draft	no	405
04/02/1993	B+	65	Well done	p	Internal final	yes	405

Examiner Onyeaka (GMC number 3486946) assessment history.

Assessment ID	Assessment type	Assessment no	date	venue	Start time	End time
091019943	OSCE (MRCCI part b)	9210004	09/10/1992	Green Square	09:15	13:00
200619943	OSCE (MRCCI part b)	9106564	20/06/1991	Station Road	09:15	13:00
021019932	OSCE (MRCCI part b)	8801050	02/01/1988	Green Square	14:00	17:00
231019911	OSCE (MRCCI part b)	8710003	23/10/1987	St. Pancreas square	09:30	12:30
130619911	OSCE (MRCCI part b)	8504576	13/06/1985	Eustation Road	09:30	12:30
020119911	OSCE (MRCCI part b)	8301057	02/01/1983	Liver Lane	14:00	17:00

List of examiners used for OSCE (MRCCI part b) on 20/06/1994 (Assessment no 200619943)

Baguley
Beaumont
Crowell
Jones
Ketelby
Khalil
Lee
Noden
Sanyal
Smith
Thompson
Wallace
Whatling
Williams

Scheduling timetable for OSCE (MRCCI part b) on 20/06/1994

(Assessment no 200619943)

time	session	venue			
		Room 102	Room 105	Room 113	Room 201
9.15am – 10am	1	*Examiners*: Smith, Wallace, Whatling *Candidate:* Baguley	*Examiners*: Andrews, Williams *Candidate*: Ibrahim	*Examiners:* Crowell, Sanyal, Thompson *Candidate:* Raiteri	*Examiners*: Ketelby, Jones, Noden *Candidate:* Ramasamy
10.15am – 11am	2	*Examiners:* Smith, Ketelby, Jones *Candidate:* Ramasamy	*Examiners:* Andrews, Williams *Candidate:* Baguley	*Examiners:* Crowell, Sanyal, Thompson *Candidate:* Ibrahim	*Examiners:* Noden, Lee, Beaumont *Candidate*: Raiteri
11.15am – 12md	3	*Examiners*: Smith, Wallace, Jones *Candidate:* Raiteri	*Examiners:* Andrews, Lee *Candidate:* Ramasamy	*Examiners:* Crowell, Sanyal, Thompson *Candidate:* Baguley	*Examiners:* Noden, Khalil, Beaumont *Candidate*: Ibrahim
12.15pm – 1pm	4	*Examiners:* Smith, Wallace, Whatling *Candidate:* Ibrahim	*Examiners:* Andrews, Lee *Candidate:* Raiteri	*Examiners:* Crowell, Sanyal, Thompson *Candidate:* Ramasamy	*Examiners:* Noden, Khalil, Beaumont *Candidate:* Baguley

Candidate Baguley timetable for OSCE (MRCCI part b) on 20/06/1994 (Assessment no 200619943)

time	venue
9.15 am – 10am	Room 102
10.15am – 11am	Room 105
11.15am – 12md	Room 113
12.15pm – 1pm	Room 201

Examiner Wallace timetable for OSCE (MRCCI part b) on 20/06/1994 (Assessment no 200619943)

time	venue
9.15 am – 10am	Room 102
10.15am – 11am	free
11.15am – 12md	Room 102
12.15pm – 1pm	Room 102

Hints if you are thinking about UML and the above scenario

- Remember to create an overview use case diagram first - this should not be too complex.

- For a pass mark you can ignore or simply add a schedule class, however for a high mark you need to model the scheduling aspect as well.

- For the Sequence diagram consider possibly an instance of a student, represented in one of the above reports taking the various assessments to gain the MRCCI Part b or alternatively the FRCCI. Remember you will need to write an instance scenario - based upon the information above which in turn will be the basis of your sequence diagram.

- This scenario makes use of a ternary association and inheritance If you feel it necessary make use of occurrence fragments to show detail in the sequence/ state diagrams

14. Colorectal screening

A combination of fact and fiction.

The NHS national colorectal screening programme is the only one of its kind in the world (http://cancerscreening.org.uk/bowel/) .The main organisational units are listed below.

Organisational unit	Description
National Screening Centre (NSC)	Coordinates activities and manages the programme (i.e. Hubs, software developer and Screening Centres).
Software developer	The system (BCSS) is a web based database for the whole of the UK, and provides functions to all the organisational units listed here.
Hubs (5 around the UK)	These administer the test kits which involves printing/posting out invitation packs, monitoring returns, running a help line including the follow up of non responders, and testing/documenting the returned kits etc. Sending negative test kit result letters to participants and GPs and informing Screening Centres about positive results. A hub is responsible for a number of screening centres. A hub is related to a number of patients.
Screening Centres	These carry out the clinical functions, such as assessment meetings and post colonoscopy meetings with Screening Specialist Nurses (SPN) and colonoscopies carried out by colonoscopists. Screening centres see/treat patients. A screening centre relates to only a single hub.
Primary Care trusts (PCTs)	Provide funding to Screening centres, and monitor patients and GPs performance by way of practices. Note: because Hubs and screening centres deal with patients based on locality a GP and consequently a PCT may relate to more than one hub. This is because the PCT holds a list of practices, GPs and their patients.
Patient/participant	Is registered with a single GP. Participants become known as patients when their test result is positive. In other words they change state. These are the focus of the program.
General Practitioners (GP)	These receive information about individual patients' results via hubs or screening centres. A GP belongs to a single practice. GPs have patients A practice is administered by a single PCT

The NHS national colorectal screening programme is an age based screening programme currently screening all those registered with a GP between the ages of 60 – 69 years.

The Hub sends out an invitation letter and test kit to all eligible people, once every two years based on their date of birth. Reminders are sent out if the participant fails to respond either by a phone call and/or returning the test kit. If the test result (from the test kit) is negative they are then recalled every 2-years on from the date of their last normal result. This currently stops when they reach 75 years old but may change in future. Subjects with an abnormal test result are sent a letter for an assessment meeting with a Screening Specialist Practitioner (SSP) which amongst other things involves assessing their suitability for colonoscopy and them explaining their need for a colonoscopy session, which is booked during the assessment meeting. Patients may have more than one assessment meeting. A single colonoscopy session may involve several treatments (i.e. removal of several polyps (Adenomas)). The patient may also undergo several colonoscopy sessions at different times. Patients receive one or more post colonoscopy sessions with the SPN. Dependent upon the result of the colonoscopy session the patient is referred to the hospital, given a date for another colonoscopy session or classed as treatment completed. The situation is explained by the SSP in the post colonoscopy session.

All the above activities are recorded on the BCSS as all workers has access to it.

The time period for a test positive patient between the first invitation (i.e. letter plus test kit) and either being referred to hospital or treatment completed or self withdrawal is classed as an episode. For a test negative patient it is the time between first invitation and the letter being sent to them informing them of a negative result. Therefore for a repeatedly negative test patient there will be a new episode every two years.

A none UML diagrammatic representation of possible patient flow is presented on the next page and provides some additional information.

The test Kit requires participants to provide 2 small smear samples from three bowel movements on a special cardboard package (details and pictures at: http://www.bowelscreening.scot.nhs.uk/wp-content/uploads/2007/06/red-kit.pdf) this is then posted free of charge back to the hub where the testing for blood is carried out on the six samples, technically called a FOBt test. All results are double entered by the laboratory technician carrying out the test. A unclear or spoilt result requires the participant to repeat the test and the test result is considered to be VOID. The reason for this is recorded. Two or more unclear results are treated as a positive result.

Patients receive a questionnaire after completion of an episode, it is returned to the screening centre where the data is entered into the BCSS system.
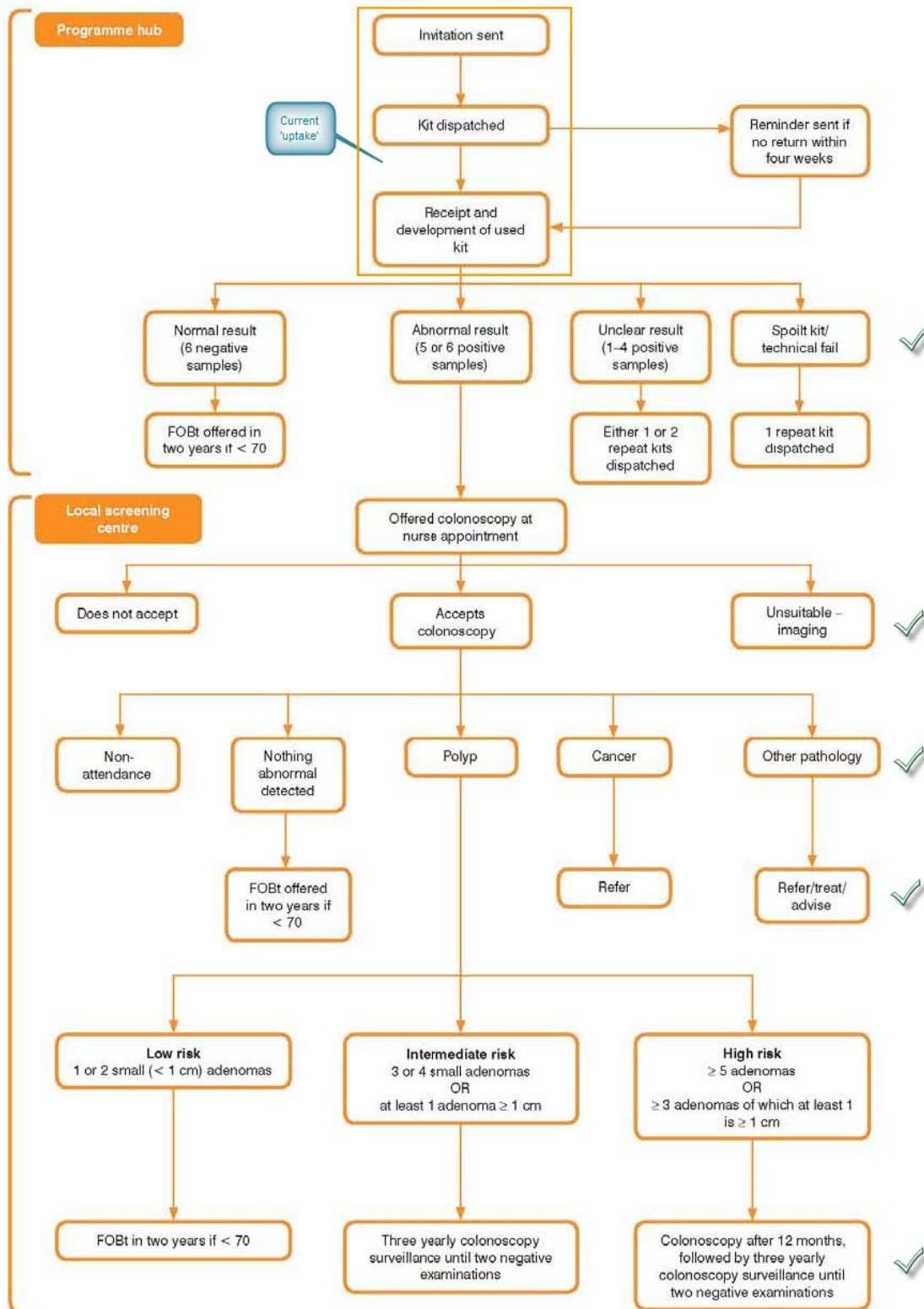
Hints if you are using UML:

1. Read the pdf document about the final assessment for the unit on the unit web site.
2. As I have mentioned before you need to be competent at creating a document that has the UML diagrams within it which can be read without zooming into 200%, note that you can make use of UML fragments if necessary. For example you probably will produce a overview Sequence diagram and than one for each of the occurrence fragments within it.
3. My Class diagram has between 20 to 30 classes for this scenario.
4. Activities are usually modelled a methods in the class diagram and must not contradict the sequence and state diagrams
5. Do not include the BCSS as a class this is what you are modelling
6. A possible instance scenario may be for a Miss Jane Smith etc.
7. A possible state diagram might be for the test class.

End of document