Extreme programming practices

Pair programming	**Developers work in pairs, checking each other's work and providing the support to always do a good job.**
Collective ownership	**The pairs of developers work on all areas of the system, so that no islands of expertise develop and all the developers take responsibility for all of the code. Anyone can change anything.**
Continuous integration	**As soon as the work on a task is complete, it is integrated into the whole system. After any such integration, all the unit tests in the system must pass.**

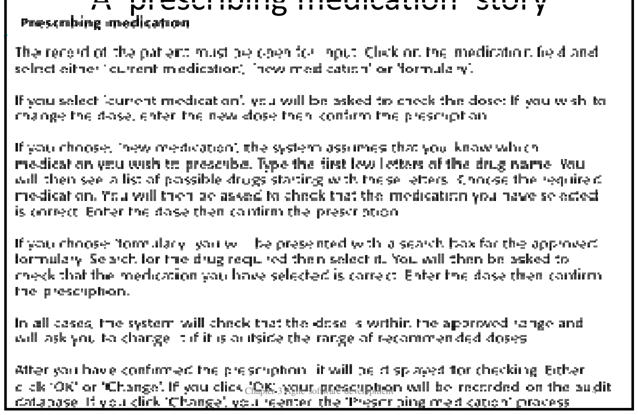
Extreme programming practices (b)

Sustainable pace	**Large amounts of overtime are not considered acceptable as the net effect is often to reduce code quality and medium term productivity**
On-site customer	**A representative of the end-user of the system (the customer) should be available full time for the use of the XP team. In an extreme programming process, the customer is a member of the development team and is responsible for bringing system requirements to the team for implementation.**

Requirements scenarios

- **In XP, a customer or user is part of the XP team and is responsible for making decisions on requirements.**
- **User requirements are expressed as scenarios or user stories.**
- **These are written on cards and the development team break them down into implementation tasks. These tasks are the basis of schedule and cost estimates.**
- **The customer chooses the stories for inclusion in the next release based on their priorities and the schedule estimates.**

A 'prescribing medication' story



Prescribing medication

The record of the patient must be open for input. Click on the medication field and select either 'current medication', 'new medication' or 'formulary'.

If you select 'current medication', you will be asked to check the dose; If you wish to change the dose, enter the new dose then confirm the prescription.

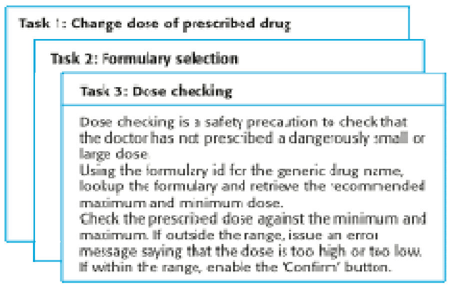
If you choose, 'new medication', the system assumes that you know which medication you wish to prescribe. Type the first few letters of the drug name. You will then see a list of possible drugs starting with these letters. Choose the required medication. You will then be asked to check that the medication you have selected is correct. Enter the dose then confirm the prescription.

If you choose 'formulary', you will be presented with a search box for the approved formulary. Search for the drug required then select it. You will then be asked to check that the medication you have selected is correct. Enter the dose then confirm the prescription.

In all cases, the system will check that the dose is within the approved range and will ask you to change it if it is outside the range of recommended doses.

After you have confirmed the prescription, it will be displayed for checking. Either click 'OK' or 'Change'. If you click 'OK', your prescription will be recorded on the audit database. If you click 'Change', you reenter the 'Prescribing medication' process.

Examples of task cards for prescribing medication



Task 1: Change dose of prescribed drug

Task 2: Formulary selection

Task 3: Dose checking

Dose checking is a safety precaution to check that the doctor has not prescribed a dangerously small or large dose.
Using the formulary id for the generic drug name, lookup the formulary and retrieve the recommended maximum and minimum dose.
Check the prescribed dose against the minimum and maximum. If outside the range, issue an error message saying that the dose is too high or too low.
If within the range, enable the 'Confirm' button.

XP and change

- "Conventional" wisdom in software engineering is to design for change. It is worth spending time and effort expecting changes as this reduces costs later in the life cycle.
- XP, however, maintains that this is not worthwhile as changes cannot be reliably predicting.
- Rather, it proposes constant code improvement (refactoring) to make changes easier when they have to be implemented.

Refactoring

- Programming team look for possible software improvements and make these improvements even where there is no immediate need for them.
- This improves the understandability of the software and so reduces the need for documentation.
- Changes are easier to make because the code is well-structured and clear.
- However, some changes requires architecture refactoring and this is much more expensive.

Examples of refactoring

- Re-organization of a class hierarchy to remove duplicate code.
- Renaming attributes and methods to make them easier to understand.
- The replacement of inline code with calls to methods that have been included in a program library.

Testing in XP

- Testing is central to XP and XP has developed an approach where the program is tested after every change has been made.
- XP testing features:
  - Test-first development.
  - Incremental test development from scenarios.
  - User involvement in test development and validation.
  - Automated tests are used to run all component tests each time that a new release is built.

Test-first development

- Writing tests **before** code clarifies the requirements to be implemented.
- Tests are written as programs so that they can be executed automatically. The test includes a check that it has executed correctly.
  - Usually relies on a testing framework.
- All previous and new tests are run automatically when new functionality is added, thus checking that the new functionality has not introduced errors.

Customer involvement

- The role of the **customer** in the testing process is to help develop acceptance tests for the stories that are to be implemented in the next release of the system.
- The customer who is **part of the team** writes tests as development proceeds. All new code is therefore validated to ensure that it is what the customer needs.
- However, people adopting the customer role have limited time available and so cannot work full-time with the development team. They may feel that providing the requirements was enough of a contribution and so may be reluctant to get involved in the testing process.

Test automation

- Test automation means that tests are written as executable components before the task is implemented
  - These testing components should be stand-alone, should simulate the submission of input to be tested and should check that the result meets the output specification. An automated test framework is a system that makes it easy to write executable tests and submit a set of tests for execution.
- As testing is automated, there is always a set of tests that can be quickly and easily executed
  - Whenever any functionality is added to the system, the tests can run and problems that the new code has introduced can be caught immediately.

XP testing difficulties

- Programmers prefer programming to testing and sometimes they take short cuts when writing tests. For example, they may write incomplete tests that do not check for all possible exceptions that may occur.
- Some tests can be very difficult to write incrementally.
- It difficult to judge the completeness of a set of tests. Although you may have a lot of system tests, your test set may not provide complete coverage.

Pair programming

- In XP, programmers work in pairs, sitting together to develop code.
- This helps develop common ownership of code and spreads knowledge across the team.
- It serves as an informal review process as each line of code is looked at by more than 1 person.
- It encourages refactoring as the whole team can benefit from this.
- Measurements suggest that development productivity with pair programming is similar to that of two people working independently.

Pair programming

- In pair programming, programmers sit together at the same workstation to develop the software.
- Pairs are created dynamically so that all team members work with each other during the development process.
- The sharing of knowledge that happens during pair programming is very important as it reduces the overall risks to a project when team members leave.
- Pair programming is not necessarily inefficient and there is evidence that a pair working together is more efficient than 2 programmers working separately.

Advantages of pair programming

- It supports the idea of collective ownership and responsibility for the system.
  - Individuals are not held responsible for problems with the code. Instead, the team has collective responsibility for resolving these problems.
- It acts as an informal review process because each line of code is looked at by at least two people.
- It helps support refactoring, which is a process of software improvement.
  - Where pair programming and collective ownership are used, others benefit immediately from the refactoring so they are likely to support the process.