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# Ethics

### 2018

#### To help counter terrorism, many countries are planning or have developed computer systems that track large numbers of their citizens and their actions. Clearly this has privacy implications. Discuss the ethics of working on the development of this type of system.

### 2017

#### Software engineering involves wider responsibilities than simply the application of technical skills. Software engineers must behave in an honest and ethically responsible way if they are to be respected as professionals. Ethical behaviour is more than simply upholding the law but involves following a set of principles that are morally correct. Discuss, in relation to the ACM/IEEE Code of Ethics, the ethics of a company releasing software without disclosing known defects. Your answer should address each of the principles of the ACM/IEEE Code of Ethics. Justify any assumptions that you make.

# Development Models

### 2018

### 2017

#### Compare and contrast the Waterfall and V Models of Software Development to the Scrum Process. Support your answer by clearly identifying and describing the phases of the Waterfall Model, V Model and Scrum process.

### 2016

#### What is the most important difference between generic software product development and custom software development? What might this mean in practice for users of generic software products?

The essential difference is that in generic software product development, the

specification is owned by the product developer. For custom product development,

the specification is owned and controlled by the customer. The implications of this

are significant – the developer can quickly decide to change the specification in

response to some external change (e.g. a competing product) but, when the

customer owns the specification, changes have to be negotiated between the

customer and the developer and may have contractual implications.

For users of generic products, this means they have no control over the

software specification so cannot control the evolution of the product. The developer

may decide to include/exclude features and change the user interface. This could

have implications for the user’s business processes and add extra training costs

when new versions of the system are installed. It also may limit the customer’s

flexibility to change their own business processes.

#### Giving reasons for your answer based on the type of system being developed, suggest the most appropriate generic software process model that might be used as a basis for managing the development of the following systems:

#### A system to control anti-lock braking in a car

#### A virtual reality system to support software maintenance

#### A university accounting system that replaces an existing system

#### An interactive travel planning system that helps users plan journeys with the lowest environmental impact.

1. *Anti-lock braking system* This is a safety-critical system so requires a lot of

up-front analysis before implementation. It certainly needs a plan-driven

approach to development with the requirements carefully analysed. A

waterfall model is therefore the most appropriate approach to use, perhaps

with formal transformations between the different development stages.

*2. Virtual reality system* This is a system where the requirements will change

and there will be an extensive user interface components. Incremental

development with, perhaps, some UI prototyping is the most appropriate

model. An agile process may be used.

*3. University accounting system* This is a system whose requirements are

fairly well-known and which will be used in an environment in conjunction

with lots of other systems such as a research grant management system.

Therefore, a reuse-based approach is likely to be appropriate for this.

*4. Interactive travel planning system* System with a complex user interface but

which must be stable and reliable. An incremental development approach is

the most appropriate as the system requirements will change as real user

experience with the system is gained.

#### Explain how the principles underlying agile methods lead to the accelerated development and deployment of software.

The principles underlying agile development are:

1. *Individual and interactions over processes and tools*. By taking advantages

of individual skills and ability and by ensuring that the development team

know what each other are doing, the overheads of formal communication

and process assurance are avoided. This means that the team can focus on

the development of working software.

2. *Working software over comprehensive documentation*. This contributes to

accelerated development because time is not spent developing, checking and

managing documentation. Rather, the programmer’s time is focused on the

development and testing of code.

3. *Customer collaboration over contract negotiation*. Rather than spending

time developing, analyzing and negotiating requirements to be included in a

system contract, agile developers argue that it is more effective to get

feedback from customer’s directly during the development about what is

required. This allows useful functionality to be developed and delivered

earlier than would be possible if contracts were required.

4. *Responding to change over following a plan*. Agile developers argue

(rightly) that being responsive to change is more effective than following a

plan-based process because change is inevitable whatever process is used.

There is significant overhead in changing plans to accommodate change and

the inflexibility of a plan means that work may be done that is later

discarded.

# Processes

### 2018

#### A process consists of skilled people employing documents, tools, and other resources to plan, perform, and improve tasks to produce a desired result. Employ an appropriate Process Description Template to describe a typical formal Review Process consisting of three main phases: Preparation, Meeting, and Follow-Up.

### 2017

#### A process consists of skilled people employing documents, tools, and other resources to plan, perform, and improve tasks to produce a desired result. Design a Process Description Template that could be employed to describe a Software Process. Identify and explain each section in your Process Description Template.

#### Employ the Process Description Template designed above to describe the Test-Driven Development Process. Test Driven Development is Specification Driven and based on designing and writing unit tests for each unit of code before writing the product code itself.

# Quality

### 2018

#### Explain why professional software is not just the programs that are developed for a customer.

#### Explain how standards may be used to capture organizational wisdom about effective methods of software development. Suggest four types of knowledge that might be captured in organizational standards.

#### What are the important differences between the agile approach and the process maturity approach to software process improvement?

#### Describe three types of software process metric that may be collected as part of a process improvement process. Give one example of each type of metric.

### 2017

#### In the context of the Capability Maturity Model Integration (CMMI) identify and describe the relationship of the following terms to each other: Process Area, Specific Goals, Generic Goals, Specific Practices, Generic Practices, Typical Work Products, and Sub-practices.

#### Explain why program inspections are an effective technique for discovering errors in a program. What types of error are unlikely to be discovered through inspections?

#### Describe three types of software process metric that may be collected as part of a process improvement process. Give one example of each type of metric.

### 2016

#### Explain how standards may be used to capture organizational wisdom about effective methods of software development. Suggest four types of knowledge that might be captured in organizational standards.

#### What are the important differences between the agile approach and the process maturity approach to software process improvement?

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# Risk Management

### 2016

#### Fixed-price contracts, where the contractor bids a fixed price to complete a system development, may be used to move project risk from client to contractor. If anything goes wrong, the contractor has to pay. Suggest how the use of such contracts may increase the likelihood that product risks will arise.

#### Cost estimates are inherently risky, irrespective of the estimation technique used. Suggest five ways in which the risk in a cost estimate can be reduced.

#### A software manager oversees the development of a safety-critical software system, which is designed to control a radiotherapy machine to treat patients suffering from cancer. This system is embedded in the machine and must run on a special-purpose processor with a fixed amount of memory (256 Mbytes). The machine communicates with a patient database system to obtain the details of the patient and, after treatment, automatically records the radiation dose delivered and other treatment details in the database.

#### The COCOMO method is used to estimate the effort required to develop this system and an estimate of 26 person-months is computed. All cost driver multipliers were set to 1 when making this estimate.

#### Explain why this estimate should be adjusted to take project, personnel, product, and organizational factors into account. Suggest four factors that might have significant effects on the initial COCOMO estimate and propose possible values for these factors. Justify why you have included each factor.