

## SQA TUTORIAL 1

1. It is claimed that no significant SQA activities are expected to take place during the phase of production planning for software products.
- a) Discuss this claim

### Answer

Correct. The product production planning stage and the manufacturing stage in the case of software products deal mainly with duplication and packaging of the product, with no activities of review or testing of the software code. Therefore, it is not expected that software defects will be detected at these stages.

- b) Compare the required production planning for a new automobile model with the production planning efforts required for the new release of a software product

### Answer

There is considerable similarity between the development of a new automobile model and a new software project. Both processes are characterized by creativity and require complicated operational options of automobiles are controlled by software (operated by the car's computer)

2. Referring to the seven environmental characteristics of software development and maintenance, consider the characteristics of future software products, discussing whether the professional and managerial burden of coping with these characteristics in future is expected to be higher or lower when compared with the current performance of these activities.

#### i. Contract conditions and commitments defining content and timetable.

→ changes → Need document to manage → signed off  
Customers can be expected to be much more demanding with respect to full implementation of functional and other requirements. Typical time schedules for similar development projects are expected to be substantially shorter than those currently allowed.

#### ii. Conditions of the customer-supplier relationship.

The nature of the future projects is likely to demand a much closer relationship between client and supplier

#### iii. Teamwork requirements

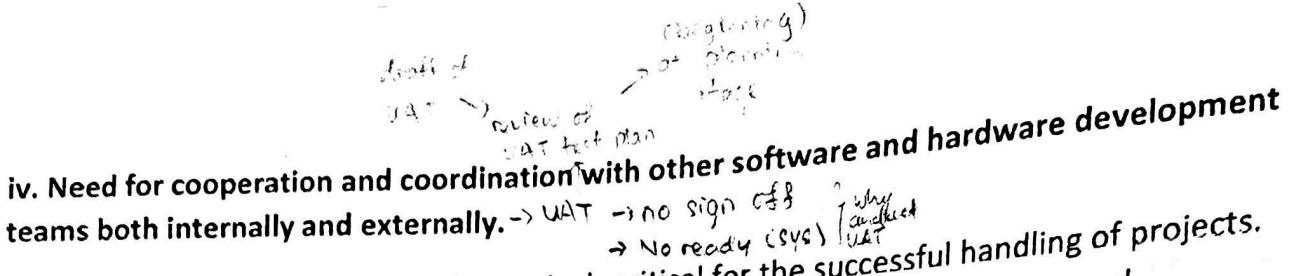
Teamwork will continue to be required, though it is expected that new technologies will be implemented to support teamwork.

- Have to relate characteristic to SQA (if out in final)

SQA : 

Software
Change
Control

 must relate to this



**iv. Need for cooperation and coordination with other software and hardware development teams both internally and externally.** → UAT → no sign off  
→ No ready (sys) | why conflict

These characteristics will become increasingly critical for the successful handling of projects.  
More comprehensive standardization will facilitate more effective coordination and cooperation.

#### v. Need for interfaces with other software systems.

The number of interfaces and the intensity of their use can be expected to increase. More comprehensive standardization of interfaces between software systems and between software and hardware will facilitate more effective development of interfaces.

#### vi. Need for community in carrying out a project when team members change. No changes

#### vii. Need for ongoing maintenance of the software system over several year. No changes

Reactive

Proactive

3. Compare and contrast of Corrective Action and Preventive Action. Provide THREE (3) IT-related examples for EACH category the action plan.

#### Answer

Corrective action is the action to found out the root cause of the problems that have occurred and correct it to ensure no other similar nonconformity could occurs. For example, UAT, Code walkthrough, Quality Control Checklist. Audit, Software design review at planning stage of SDLC.

Preventive action is the action to avoid non-compliant problems. For example, training employees to use the software, Software development process, follow company quality manual, applied lesson learned from previous mistake. Software design review at the planning stage of PLC.

no client  
will be involve

4. The need to carry out work by a team demands additional investment in coordination of the team members. Discuss whether these managerial efforts could be saved if the work were performed as a "one-man job".

#### Answer

Teamwork obviously requires a team leader, who needs to spend much on coordination among the team members, so that the work done by each of them can be assembled into a unified software system. The costs of these activities are overheads to software development costs. Obviously, these extra costs are negligible by operating via a "one-man show". It should be emphasized, however, that a substantial part of a team leader's time is invested in checking the work of the team members. If the project is "one-man show" the task of checking still needs to be performed by another member of the staff, possibly the head of department.

## SQA TUTORIAL 2

1. It is claimed that the expanded definition of SQA supports those who are interested in increasing client satisfaction.

- a) Do you agree with this claim? Agree
- b) If yes, provide arguments to substantiate your position

### Answer

SQA is a process to ensure the project quality by manage the schedule, budget of the project and meet user requirement at the same time. Software errors are reduced substantially by fully achieving all the quality goals. Moreover, SQA will also help in maintenance software quality throughout the software life cycle and leads to continuing satisfaction of client. Thus, SQA supports will help to increases the customer satisfaction.

2. The software requirement document for the tender for development of "Super-lab," a software system for managing a hospital laboratory, consists of chapters according to the required quality factors as follows: correctness, reliability, efficiency, integrity, 正確 / 完整, usability, maintainability, flexibility, testability, portability, reusability and interoperability.

In the following table you will find sections taken from the mentioned requirements document. For each section, fill in the name of the factor that best fits the requirement (choose only one factor per requirements section).

No.	Section taken from the software requirement document	The requirements factor
1	The probability that the "Super-lab" software system will be found in a state of failure during <u>peak hours (9 am to 4 pm)</u> is required to be <u>below 0.5%</u> . <small>file / Data synchronization</small>	reliability
2	The "Super-lab" software system will enable <u>direct transfer</u> of laboratory results to those files of hospitalized patients <u>managed by the "MD-File" software package</u> .	interoperability
3	The "Super-lab" software system will include a module that prepares a <u>detailed report of the patient's laboratory test results</u> during his current hospitalization. (This report will serve as an appendix to the family physician's file.) The time required to obtain this printed report will be <u>less than 60 seconds</u> ; the level of accuracy and completeness will be <u>at least 99%</u> .	correctness (referring to availability, accuracy and completeness)
4	The "Super-lab" software to be developed for hospital laboratory use may be adapted later for private laboratory use.	flexibility
5	The training of a laboratory technician, requiring <u>no more than 3 days</u> , will enable the technician to <u>reach level C</u> of "Super-lab" software usage. This means that he or she will be able to manage reception of <u>20 patients per hour</u> .	usability
6	The "Super-lab" software system will record a <u>detailed users' log</u> . In addition, the system will report attempts by unauthorized persons to	integrity

	obtain medical information from the laboratory test results database. The report will include the following information: the network identification of the applying terminal, the system code of the employee who requested that information, the day and time of attempt and the type of attempt.	
7	The "Super-lab" subsystem that deals with billing patients for their tests may be eventually used as a subsystem in the "Physiotherapy Center" software package.	usability
8	The "Super-lab" software system will process all the monthly reports for the hospital departments' management, the hospital management, and the hospital controller according to Appendix D of the development contract.	correctness
9	The software system should be able to serve 12 workstations and 8 automatic testing machines with a single model AS20 server and a CS25 communication server that will be able to serve 25 communication lines. This hardware system should conform to all availability requirements as listed in Appendix C.	efficiency
10	The "Super-lab" software package developed for the Linux operating system should be compatible for applications in a Windows NT environment.	portability (difference / OS)

3. "Quantitative measures are usually preferred to qualitative measures when choosing quality goals because they provide the developer with more objective assessments of software performance during the development process and system testing. However, one type of goal is not totally equivalent to the other."
- a) How are quantitative goals applied during the development process?

#### Answer

Quantitative goals can be used in pre-test, which enable the developer to measure the current performance and decide about the maturity of the development efforts. For example, A quantitative goal of 99.8% accuracy is set for a computerized input device. In pre-test, the developer can objectively evaluate the current achievements.

- b) Explain in what way quantitative goals enable more objective evaluation of performance when compared with qualitative goals.

#### Answer

Qualitative goals, such as friendly, efficient or easy-to-use are open to wide range of evaluations, where usually the developer expresses his satisfaction while the customer is less enthusiastic or even dissatisfied. Situations like this, of quantitative goals are much less debatable. Usually the application of an additional test sample will resolve the disagreements.

4. Some people claim that testability and verifiability are actually different names for the same factor.

- a) Do you agree? Disagree
- b) If not, could you explain why?

**Answer**

Both testability and verifiability refer to the SQA processes during software development, requiring software features that make the SQA processes easier. However, while verifiability is limited to verification processes, testability includes validation and qualification processes performed throughout the development processes. Also, while verifiability is limited to the software development processes, testability requirements are extended to refer to the entire software life cycle. Testability requirements refer to failure detection and analysis during regular operation of software or when a failure occurs.

### SQA Tutorial 3

1. It is said that failure to meet the interoperability requirements can negatively affect the correctness level of the software system, and even can cause nonconformance with correctness requirements.

a) Elaborate on the above statement and explain the mentioned interconnections between factors.

#### Answer

Most interoperability requirements refer to automatic transfer of data from one system to another, where one system may be an information system or computerized equipment that transfer its output into an information system. Failure to meet interoperability requirements are mainly of two types.

- A. Data transfer fails and have to transfer data manually.
- B. Data transfer process is defective and causes undesirable changes of data and entire data records to be deleted.

Correctness dimension	Type A	Type B
Accuracy	Manual input processes resulting in much higher rates of input errors than computerized data transfer. Expected input accuracy will fall below required level.	Defective transfer process that involves erroneous input records affects by definition, the input accuracy, which may fall beneath the minimal level of accuracy.
Completeness	Manual input processes are under a much higher risk of losing records than the computerized system. Thus, non-compliance with completeness requirements could be expected.	Defective transfer process that involves missing input records affects, by definition, the completeness of input may fall beneath the minimal level of completeness.
Updated / up-to-dated	Manual input processes require much more time than computerized system, this causes late updating database. Thus, non-compliance with update requirements could be expected.	Defective transfer process may lead to loss or damage input data needed for updating database. As a result, level of updated may drop below the required level.
Availability	As availability refers to response time, where the processing is based on data available at the moment of request, no effect is expected on availability, even in cases where severe decline in accuracy and completeness exists.	No effect on availability is expected for type B failures.

Data migration → upgrade of system

- Direct Cutover
- Phas. Cut
- Parallel

b) Provide an example of a situation where such effects are to be expected.

**Answer**

This may happen when local store information system interoperates with central inventory system and has to transfer transactions of sales and suppliers' shipments to central system. The central system supplies information on availability of items to other stores. With this application it can help to fulfill client's orders when insufficient quantity item in local store.

Failure to comply this interoperates requirements may cause inaccurate, incomplete and outdated information in others stores. This may result in unable to supply item for clients order on time and effect store reputation and lose in finances for extra fees to repair the system.

2. Development process mapping is one of the most important elements of the development plan.

a) List the possible phases of the development process.

**Answer**

Requirement definition, Analysis, Design, Coding, Testing, Installation.

b) List possible inputs and outputs for each of the phases suggested in (a).

**Answer**

Development phase	Input	Output
Requirement definition	-	a. Requirement document (system and software)
Analysis	a. Requirement document (system and software)	a. Preliminary design document b. Software test plan
Design	a. Preliminary design document b. Software test plan	a. Critical design document b. Software test procedure c. Software installation plan d. Software maintenance manual
Coding	a. Critical design document	a. Software test report b. Project code (complete version with system tests)
Testing	a. Software test plan b. Software test procedure c. Project code	a. Tested and corrected version of project code b. Software user manual
Installation	a. Tested and corrected version of project code b. Software installation plan	-

c) What components of each activity, as associated with each project phase, should be described in the development plan?

**Answer**

- An estimate of activity's duration
- Logical sequence in each activity to be performed, including a description of each activity's dependence on previously completed activities
- Type of professional resources required and estimates of how much of these resources are necessary for each activity.

3. "As long as the proposal was properly prepared and approved, following an adequate contract review, there is no justification for redoing all this work. Its resource estimates and schedule can serve as the project's plan...." You often hear claims like this one.

a) Do you agree with this claim? If not – list your arguments against it.

**Answer**

Not agree, the plans examine possible changes that have occurred since the time the proposal was submitted. Next, the plans examine the actual up-to-date availability of team members, subcontractor's participation and laboratory resources. Examples, available to adapted project schedule.

b) Suggest situations where it is clear that the proposal and its materials can serve as development and quality plans.

**Answer**

- Simple small to medium projects with no external participants.
- Projects where only a short time period has elapsed since the time proposal was submitted.

c) Suggest situations where it is clear that the proposal and its materials cannot serve as development and quality plans.

**Answer**

- Complicated or large projects involving external participants, where a substantial time has elapsed since the submission of the proposal
- Projects where substantial changes of requirements result from negotiations that were held with customer in the interim period after the proposal had been submitted and before signing the contract.

## SQA Tutorial 4

1. An experienced project leader has identified 6 SRIs inherent in his project and estimated their Est(dam) and Prob(mat). The results are listed in the following table:

No.	SRIs	Prob(mat)	Est(dam) \$	Exp(risk) \$
1	Networking at the customer's 23 sites will not be completed on time	0.2	150,000	30,000
2	Subcontracted modules will fail the acceptance tests	0.5	12,000	6,000
3	The programming team will be 2-3 programmers short for more than 2 months	0.7	50,000	35,000
4	The software quality assurance activities will fail to detect major software errors in the complicated discount module; these errors will be discovered by the customer during the guarantee period	0.05	600,000	30,000
5	The final test of the user's guide will detect significant errors that will cause a delay of more than 2 weeks in delivery to the customer	0.3	2,500	750
6	The planned server's capacity will be found insufficient in the final system tests	0.25	40,000	10,000

a) Determine the priorities for these SRIs.

Answer

$$Exp(risk) = Est(dam) \times Prob(mat)$$

3, 1, 4, 6, 2, 5

or

3, 4, 1, 6, 2, 5

b) Can you suggest an alternative method for prioritizing the SRIs?

Answer

- Can Based on Est(dam) alone to prioritizing the SRIs.

4, 1, 3, 6, 2, 5

c) Determine the SRI priorities according to the alternative method. Compare the resulting priority list with that obtained in (a), and discuss the implications of the differences, if any.

Answer

2. With respect to verification, validation and qualification:

a) Explain the differences between these three aspects of SQA activities.

Answer

Verification is the process of evaluating a system to determine whether the products of given development phase satisfy the conditions at start of the phase (Check the requirements is correct or not).  
requirement ← technical and managerial (standard)

Validation is the process of evaluating a system during or at the end of development process to determine whether it satisfies specified requirements.  
intended use, user needs and expectation.

Qualification is the process used to determine whether system is suitable for operational use.

While verification focuses on detecting incorrect implementation or deviations from the results of the former phase of software development, validation deals with identifying incorrect implementation or deviations from the functional specifications and other requirements defined for the project by customer. Qualification emphasizes the detection of deviations from the work orders of the organizations and from the standards of analysis, design and coding prepared by development team, regardless of whether the software is correct or not, according to its verification and validation tests.

b) Can a project that successfully passed verification and validation reviews but failed part of the qualification review adequately supply users with the information needed? Explain your answer.

Answer

It's possible for tested software to achieve correct functioning (no verification and validation errors) to fail qualification tests when developed programs are correct but are not in accordance with standards, procedures and work procedures of organization. It is typical for new staff or subcontractor's staff not to be fully knowledgeable of these organizational requirements. In some cases, even experienced staff under time pressures might not follow the organizations procedure.

c) In which respects is the project described in (2) inferior to a project that passed all three reviews? In what way will this difference affect operation of the software system?  
Weak ]

Answer

Deviations from the software development standards, procedures and work instructions of the organization may cause difficulties in testing software for replacement staff assigned to continue the work of a team member who left in middle of project. It will also cause difficulties for maintenance team performing corrections, changes and additions software package.

3. Consider the expected severity of software system failure.  
a) What are the main issues that cause the degree of severity?

Answer

- Loss of lives
- financial loss (company)
- malfunctioning on system (services and processes).
- safety issues

- b) Referring to your answer to (1), can you list three examples of software development projects displaying highly severe failures?

Answer

- hospital software that control medical condition of patients in intensive care room.
- Software controlling flight of guided missile / Airplane clash cause of system malfunctioning
- Shopee server down for 1days causing financial loss especially when there is discount event from Shopee
- Software controls customer's credit and prevents undesirable sales that exceed the credit limit.

- c) Referring to your answer to (1), can you list three examples of software development projects displaying low severity failures?

Answer

- Software for computerized games
- Software for managing the distribution of advertising pamphlets
- Software for controlling the random selection of background musical pieces.

## SQA TUTORIAL 5

1. There are four direct objectives and two indirect objectives attached to the various review methods.

a) List the direct and indirect objectives of each review method surveyed.

### Answer

<u>Objectives</u>	<u>Design Review</u> ↳ DR	<u>Various Review Methods</u>		
		Inspection	Walkthrough	Expert opinion
<u>Direct Objective</u>				
1.Detect errors	M	M	M	M
2.Identify new risks	M			S
3.Locate deviations from templates		M		
4.Approve the design document	M		S	

### Indirect Objectives

1.Knowledge exchange	M	M	M	S
2.Support corrective actions	S	M		

M = Main objective, S = Secondary objectives

b) For each objective, indicate the review technique or techniques that contribute(s) the most to achieving that objective.

### Answer

#### Objectives

Review method that contributes the most achieving that objectives

#### Direct Objective

1.Detect errors	All methods
2.Identify new risks	DR
3.Locate deviations from templates	Inspection
4.Approve the design document	DR (the only method assigned for this objective)

#### Indirect Objectives

1.Knowledge exchange	DR (higher professional levels), Inspection (peers level)
2.Support corrective actions	Inspection

2. One of the objectives of reviews is to identify deviations from templates, style procedures and conventions. Explain the importance of enforcing templates and sticking to style procedures and conventions <sup>inspection</sup> ~~name~~ 13/13

### Answer

The quality risks of non-compliance – increase rate of errors – stem from:

- Team members who need to coordinate their own codes with code modules developed by “non-complying” team members can be expected to encounter more than the usual number of difficulties when trying to understand the software developed by the other team member.
- Individuals replacing the “non-complying” team member (who has retired or been promoted) will find it difficult to fully understand his work.
- The design review team will find it more difficult to review a design prepared by a non-complying team.
- The test team will find it more difficult to test the module; consequently, their efficiency is expected to be lower, leaving more errors undetected. Moreover, team members required to correct the detected errors can be expected to encounter greater difficulties when doing so. They may leave some errors only partially corrected, and even introduce new errors as a result of their incomplete grasp of the other team member’s work.
- Maintenance teams required to contend with the “bugs” detected by users and to change or add to existing software will face difficulties when trying to understand the software and its documentation. This is expected to result in an excessive number of errors and the expenditure of an excessive amount of maintenance effort.

- ① - Team members
- ② - Individuals to replace
- ③ - Design Reviewer
- ④ - Tester / Developer
- ⑤ - Maintenance team

3. One can expect that in many cases, participants in an inspection session are able to suggest solutions for a detected defect or, at least, point out possible directions for its solution. While it is clear that these suggestions are crucial for the development team, it is commonly recommended to avoid any discussion about solutions during the inspection session.

a) List your arguments in favor of this recommendation.

Answer

It is recommended to avoid discussions about solutions during the inspection sessions as

- it saves the inspection team's time
- it avoids the team's inability to complete the session's planned agenda (what it supposed to do).

b) What other kinds of cooperation between the moderator and the review team would you prefer to observe in a session?

Answer

The moderator is also expected:

- To avoid deviations by team members from the inspection issues.
- To avoid personal comments by team members and focus on professional issues of the inspected document.
- In cases of disagreement between the team members – to document the case and shift the discussion to a different forum or to a special meeting.

4. Explain in your own words why big bang testing is inferior (weak) to any method of incremental testing conducted for software packages that are not small.

Answer

- Medium and large software packages are composed of many modules, interconnected by software code instructions. As a result, an error in one module may cause software faults in several other modules.
- A software fault does not necessarily happen in the module where the original error is located. Therefore, by applying big bang testing we may frequently face a situation where we find it difficult to allocate the origin of the error that caused the discovered software fault.
- Therefore, in a great many of these cases the proposed corrections are erroneous. Accordingly, by applying a big bang testing plan, it is difficult to achieve high software quality (revealing a high percentage of errors and performing the right corrections).

## SQA Tutorial 6

1. Explain in your own words what the terms of path coverage and line coverage mean and list the main differences between these coverage metrics. Explain why the implementation of path coverage is impractical in most test applications.

### Answer

- Path coverage requires that every possible calculation path be covered by a test case. Thus, path coverage requires that a line in the program be tested several times as required by its inclusion in the various calculation paths. On the other hand, line coverage requires that each of the software lines be tested at least once. In other words, we may avoid tests of calculation paths when all their lines were previously tested.  
repeation
- The implementation of path coverage requires performing a large number of test cases as a typical medium software package allows for hundreds of thousands or even millions of different operation paths. This fact and more specifically the time and budget considerations, makes it impractical to perform plan for path coverage in almost all software packages. Consideration of achieving path coverage is limited to programs where highly severe damages are expected in case of software failure, as in medical intensive care equipment, aviation equipment and weapon systems. In these cases, one may apply path coverage to those modules that signify the highest damage potential.

2. Reviewing the advantages and disadvantages of automated software testing:
- a) Explain the main advantages and disadvantages of automated tests in your own words.

### Answer

#### Advantages

- [4]
- The tests are performed accurately and completely as planned. Manual tester is sometimes inaccurate and do not perform test plans completely.
  - The test's documentation of findings is accurate in its lists and summary reports, when compared with manual reporting that may be inaccurate and incomplete.
  - Automated computerized reports, compared to manual reports, are naturally more comprehensive and allow for a greater variety of information types to be provided.
  - Performing the tests requires almost no human effort, while manual testing is a major "consumer" of tester's time.
  - Performance of an automated test requires much less time than performing the same test manually. In addition, automated tests may be performed continuously 24 hours a day 7 days a week, while it is difficult to operate manual tests during the night shift or during weekends.
  - The fact that performing automated tests is quick and does not require much in the way of human resources, allows us to plan full size regression tests and so identify errors caused in unexpected parts of the package by erroneous corrections (in package parts the planners will decide not to include manual regression tests in order to save tester's resources).
  - Automated testing allows performing test types that are practically impossible to perform manually, to mention here especially, the various types of load tests.

#### Disadvantages

- The software packages for automated testing are very expensive and the training of staff to the required level of expertise in operating automated tests is long and therefore very expensive.
- The development costs of automated testing package to deal with a new type of software are very expensive.
- The preparation of an automated test plan requires high manpower resources (of a highly specialized team).

- b) Referring to your answer(a). suggest what project characteristics are most suitable for automated testing. List your assumptions.

**Answer**

For many types of programming automated testing packages are not available.

- c) Referring to your answer(a). suggest what project characteristics are most unsuitable for automated testing. List your assumptions.

**Answer**

Project types that are most suitable are the more complicated software packages where only a small part of the software is developed based on recycle modules provided an automated testing tool is available. In projects of this mature a detailed and accurate control of identified errors and follow up of their corrections is essential, the capability to carry out fail system regression tests is very critical. To these project characteristics one should add projects which are planned to serve a great number of users, and where the availability requirements are to be achieved at all times, especially in periods of high usage. Examples of applications of this type are bank teller systems and police inquiry systems that serve "on line" policemen on patrol missions.