53701 (Software Project Management) Answer Key

Q. P. Code: 57826

(2½ Hours)

[Total Marks: 75]

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt *any three* of the following: **15**

a. Briefly explain the different phases of project management life cycle.

- Project Initiation
  - Starts with project concept development
  - Characteristics throughly understood-Scope,project constraints,cost,benefit
  - Determine whether technically and financially feasible
  - Business case is developed
  - Project manager is appointed, Project team is formed
  - Project charter is written
  - Project bidding- to select a suitable vendor
- Project Planning
  - Project plan-Identifies project tasks, schedule, assign resources and time frames to the task
  - Resource plan-Lists resources,manpower and equipment
  - Financial plan-Manpower,equipment and other costs
  - Quality plan-Quality targets and control plans
  - Risk plan-Lists the identification of risks,priority and plan for actions
- Project Execution
  - Ensure that tasks ae executed as per plan
  - Corrective actions are initiated whenever deviations from the plan
- Project closure
  - Release all the required deliverables and resources
  - Supply ageements with the vendor are terminated
  - Pending payments are completed
  - Post implementation review,List the lessons learned

b. What is project charter in software project management ?What are the elements of project charter?

- High-level document that authorizes the stating of the project and use of required resources
- Outlines project objectives,deliverables and the required resources required
- Signed and issued by a member of top management of company who takes up role of sponsor
- Not expected to change throughout the life cycle of project
- Project sponsor champions the project, monitors progress of project, provide feedback and help in removing any obstacle
- Serves as a guiding document for all activities concerning the project

The project charter contains the following elements

- Overall objectives of the project and the broad items that are within the scope of the project and those that are out of scope.

- The time schedule in terms of start date and the expected completion date of the project
- Important stakeholders and their responsibilities
- Overview of resources needed and overall budget
- Major risks to the project and strategies for overcoming

c. What is project portfolio management? Explain the key aspects of project portfolio management.

Project portfolio management provides an overview of all the projects that an organization is undertaking or is considering.It prioritizes the allocation of resources to projects and decides which new projects should be accepted and which existing ones should be dropped.Three key aspects of PPM are

- Project portfolio definition
  - Record in a single repository details of all projects
- Project portfolio management
  - Details costings of projects and managers hope are recorded
  - Actual performance are tracked
- Project portfolio optimization
  - Better balance of projects may be achieved
    - Profitable ,but risky
    - Modest benefits,fewer risks

d. Define the following terms:

i)Net profit ii)Return on Investment iii)Payback period iv)Net present value v)Internal rate of return

- Net Profit is the difference between total cost and total income over the life of the project.
- Payback Period is the time taken to break even or pay back initial investment.
- The return on investment is the average annual profit compared to total investment

$$ROI = \frac{average annual profit}{total investment} \times 100$$

- Net Present value is the sum of all incoming and outgoing payments, discounted using an interest rate, to a fixed point in time (the present)

$$\text{Present value} = \frac{value in year t}{(1+r)^t}$$

- *Internal rate of return* (IRR) is the interest *rate* at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero

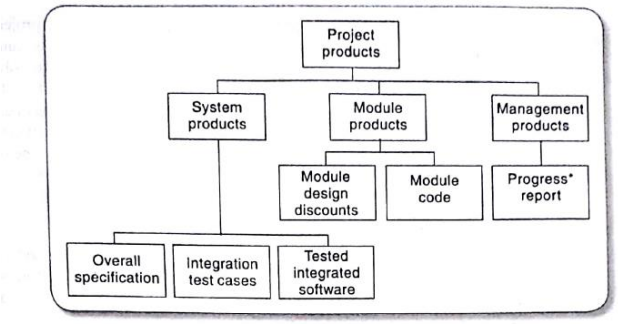
e. What is a project product? Explain Product Breakdown Structure with the help of example.

A product is the result of an activity

- Eg:Training material, planning document, software design document, Trained user

PBS is a visual aid that represents the relationship between the products and sub-products in a project.

Products will form a hierarchy which is documented in PBS



A fragment of a Product Breakdown Structure for a system development task
(* indicates that further progress reports can be added during the course of the project.)

f. What do you mean by scope and objective of a project? List the activities involved in identifying project scope and objective.

Objective
- Define what the project team must achieve for project success
- Outcome of project rather than tasks
- Predetermined results to which effort is directed

Scope
- Defines the boundaries of its application
- Output+outcome+benefit+work required to produce them

Steps involved in identifying project scope and objective are
- Identify objectives and practical measures of the effectiveness in meeting those objectives
- Establish Project Authority
- Stakeholder analysis-Identify all stakeholders in the project and their interests
- Modify objectives in the light of stakeholder analysis
- Establish methods of communication channels amongst stake holders

2. Attempt *any three* of the following: **15**

a. What do you understand by the term 'ceremonies' in a scrum project? Explain the different types of ceremonies that are observed in a Scrum project and their significance.

The term scrum ceremonies is used to denote the meetings that are mandatorily held during the duration of a project.
- Sprint Planning
  - Team members commit to develop and deliver certain features in the ensuing sprint
  - Product owner works with the team to negotiate which product backlog item the team should work
  - Scrum master has to ensure that the team agrees to realistic goals for a sprint
- Daily scrum
  - Stand-up meeting to review the status of progress achieved and major issues faced on day-to-day basis
  - Scrum master track the progress and helps to address any problems that need immediate attention
- Sprint review meeting
  - Team demonstrates the new functionality developed during the sprint
  - Feedback taken –Taken into account in the next sprint or added to product backlog

b. List the advantages and disadvantages of software prototyping.

Advantages

- Learning by doing
- Improved communication
- Improved user involvement
- Clarification of partially known requirements
- Demonstation of consistency and completeness of specification
- Reduces the need for documentation
- Reduces maintenance costs
- Feature constraint
- Production of expected results

Disadvantages

- Users may misunderstand the role of the prototype
- Lack of project standards possible
- Lack of project control
- Additional expense of building prototype
- Machine efficiency
- Close proximity of developers

c. Explain the five major components of Albrecht Function Point Analysis.

- External input (EI) types – input transactions which update internal computer files
- External output (EO) types – transactions which extract and display data from internal computer files. Generally involves creating reports.
- External inquiry (EQ) types – user initiated transactions which provide information but do not update computer files. Normally the user inputs some data that guides the system to the information the user needs
- Logical interface file (LIF) types – equates roughly to a data store in systems analysis terms. Created and accessed by the target system
- External interface file types (EIF) – where data is retrieved from a data store which is actually maintained by a different application

d. What is effort multipliers in COCOMO II model? List the effort multipliers used at early design.

In COCOMO II the effort multipliers adjust the estimate to take account of productivity factors. Each of these multipliers is given a rating of very low, low, nominal, high or very high .Each rating for each em has an associated value.A value grater than 1 increases development effort and value less than 1 decreases it.The nominal value means that the multiplier has no effect.The multipliers relevant to early design are

- Product reliability and complexity
- Required reusability
- Platform difficulty
- Personnel capability
- Personal experience
- Facilities available
- Schedule pressure

e. Explain eight core principles of Dynamic Systems Development Method.

- Focus on the business need
- Deliver on Time
- Collaborate
- Never Compromise Quality
- Build Incrementally from Firm Foundations

- Develop Iteratively
- Communicate Continuously and Clearly
- Demonstrate Control

f. State Capers Jones rules of thumb for software estimation.

- Rule 1: SLOC-function point equivalence:
  - One function point = 125 SLOC for C programs.
- Rule 2: Project duration estimation:
  - Function points raised to the power 0.4 predicts the approximate development time in calendar months.
- Rule 3: Rate of requirements creep:
  - User requirements creep in at an average rate of 2% per month from the design through coding phases
- Rule 4: Defect removal efficiency:
  - Each software review, inspection, or test step will find and remove 30% of the bugs that are present.
- Rule 5: Project manpower estimation:
  - The size of the software (in function points) divided by 150 predicts the approximate number of personnel required for developing the application
- Rule 6: Number of personnel for maintenance
  - Function points divided by 500 predicts the approximate number of personnel required for regular maintenance activities.
- Rule 7: Software development effort estimation:
  - The approximate number of staff months of effort required to develop a software is given by the software development time multiplied with the number of personnel required

3. Attempt *any three* of the following: **15**

a. With the help of example explain forward pass and backward pass to calculate activity duration in network diagram.

The forward pass rule:the earliest start date for an activity is the earliest finish date for the preceding activity.Where there is more than one immediately preceding activity take the latest of the earliest finish dates for those activities.

The backward pass rule:the latest finish date for an activity is the latest start date for the activity that commences immediately that activity is complete.Where more than one activity can commence take the earliest of the latest start dates for those activities (Any example)

b. Define the following terms

i)Critical path ii)Float iii)Free float iv)Interfering float v)Hammock activity

- Critical path is the path through network with zero floats.Any delay in an activity on this path will delay whole project
- Float is the measure of how much the start or completion of an activity may be delayed without affecting the end date of the project. Float=0 implies that any delay in carrying out the activity will delay the completion date of the project as a whole
- Free Float is time by which an activity may be delayed without affecting any subsequent activities.It is the difference between the earliest completion date for the activity and earliest start date of the succeeding activity
- Interfering float is how much the activity may be delayed without delaying the project end date-eventhough it will delay the start of subsequent activities
- Interfering float = total float – free float

- Hammock activities are activities which have zero duration and to start at the same time as the first hammocked activity and to end at the same time as the last one. They are used to represent overhead costs or other resources that will be incured or used at a constant rate over the duration of a set of activities

c. Explain Boehm's top ten software project risks and the different strategies for reducing it.

Risk	*Risk reduction techniques*
Personnel shortfalls	Staffing with top talent; job matching; teambuilding; training and career development; early scheduling of key personnel
Unrealistic time and cost estimates	Multiple estimation techniques; design to cost; incremental development; recording and analysis of past projects; standardization of methods
Developing the wrong software functions	Improved software evaluation; formal specification methods; user surveys; prototyping; early user manuals
Developing the wrong user interface	Prototyping; task analysis; user involvement
Gold plating	Requirements scrubbing, prototyping, design to cost
Late changes to requirements	Change control, incremental development
Shortfalls in externally supplied components	Benchmarking, inspections, formal specifications, contractual agreements, quality controls
Shortfalls in externally performed tasks	Quality assurance procedures, competitive design etc
Real time performance problems	Simulation, prototyping, tuning
Development technically too difficult	Technical analysis, cost-benefit analysis, prototyping , training

d. Write short note on Project Evaluation and Review Technique.

- PERT is a method to evaluate and estimate the time required to complete a task within deadlines.
- PERT requires three estimates
  - Most likely time (m) the time we would expect the task to take normally
  - Optimistic time (a) the shortest time that could be realistically be expected
  - Pessimistic (b) worst possible time
- 'expected time' $t_e = (a + 4m + b) / 6$
- 'activity standard deviation' $S = (b-a)/6$
- $z=(T- t_e)/s$ where t_e is the expected date and T is the target date
- The PERT technique uses the following three step method for calculating the probability of meeting or missing a target date

- Calculate the standard deviation of each project event
- Calculate the z value for each event that has a target date
- Convert z values to a probabilities

e. Explain the different categories of cost incurred in a software project.

Cost are categorized as

- Staff costs
  - Includes salary, social security contributions by the employer, holiday pay etc.
  - Timesheets are often used to record actual hours spent on each project by an individual
  - One issue can be how time when a staff member is allocated and available to the project, but is not actually working on the project, is dealt with.
- Overheads
  - Space rental, interest charges,service charges etc.
  - Some overheads might be directly attributable to the project; in other cases a percentage of departmental overheads may be allocated to project costs
- Usage charges
  - some charges can be on a 'pay as you go' basis e.g. telephone charges, postage, car mileage – at the planning stage an estimate of these may have to be made

f. What is resource smoothing? Explain two different ways of prioritizing activities for resource allocation.

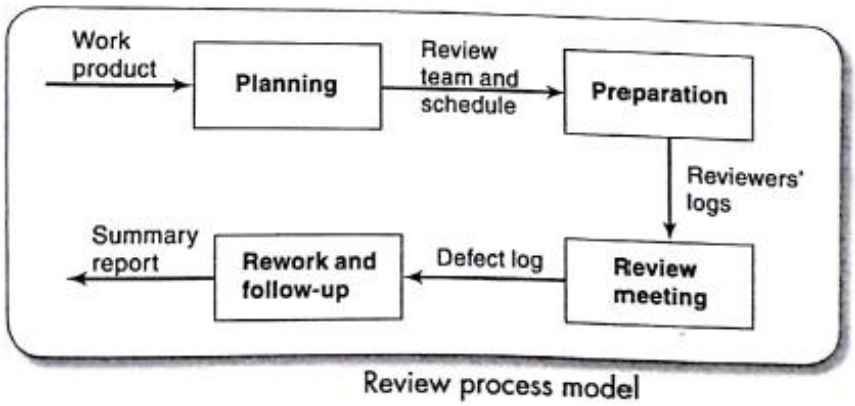
Resource smoothing is a technique that adjusts the activities of a schedule model such that the requirements for resources on the project do not exceed certain predefined resource limits.

There are two main ways of prioritizing activities:

- *Total float priority* – those with the smallest float have the highest priority
- *Ordered list priority* – this takes account of the duration of the activity as well as the float .Burman's priority list give priority to:
  - Shortest critical activities
  - Other critical activities
  - Shortest non-critical activities
  - Non-critical activities with least float
  - Non-critical activities

4. Attempt *any three* of the following: **15**

a Explain review process model with the help of diagram.



Review process model

- Planning
  - Author submits work product

- Project manager nominates moderator
- Preparation
  - Moderator convenes a brief preparation meeting
  - Copies of Work product distributed
  - Author presents an overview
  - Moderator highlights objective
  - Individual observations in review log
- Review Meeting
  - Reviewers give their comments
  - Moderator ensures that discussion is focussed and productive
  - Recorder scribes all the defects
- Rework
  - Author carry out necessary modifications
  - Corrected work product is circulated among team members
  - Final summary report of the review is prepared

b What is meant by software configuration management? Explain the two principal activities of configuration management.

- SCM is concerned with tracking and controlling changes to a software.
- Two principal activities:
- Configuration identification
  - Work products-controlled, pre-controlled and uncontrolled
  - Controlled products are those that are put under configuration control
    - SRS,Design document,Tools,Source code,Test cases,problem reports
- Configuration Control
  - Allow authorized changes to the controlled objects and prevents unauthorized changes
  - Two main operations:
    - Reserve
    - Restore

c Explain the main sections in a requirement document for contract placement.

Main sections in a requirement document

- Introduction
- A description of any existing systems and the current environment
- The customer's future strategy or plans
- System requirements
  - Mandatory
  - Desirable
- Deadlines
- Additional information required from potential suppliers

The requirement

- Define functions, inputs and outputs
- State the standards to be adhered to
- other applications with which software is to be compatible
- Operational and quality requirements Eg: usabillity,reliability..
- Avoid technical specification of possible solutions
- Each requirement need to be identified as Mandatory or desirable
- Request for information needed to judge the standing of organization itself Eg:Financial reports, references ,CVs

d What is fixed price contract? List the advantages and disadvantages of fixed price contract.

Fixed price contract

- A price is fixed when the contract is signed
- If no change in contract ,this is the price they pay on completion
- Once the development is under way the customer cannot change their requirements without renegotiating the price of the contract

Advantages to customer

- Known customer expenditure
- Supplier motivated to be cost-effective

Disadvantages

- supplier will increase price to meet contingencies
    - Supplier absorbs the risk in the estimates
    - Supplier will add a margin to price quoted
- Difficult to modify requirements
- Cost of changes likely to be higher
- Threat to system quality

e What are three important categories of stress management techniques?

- Imagery, relaxation, and meditation
    - Deep breathing,relaxation,physical exercise,guided imagery, yoga,progressive muscle relaxation and massage theraphy
    - An example of a simple relaxation technique can be rolling the head from side to side
- Cognitive behaviorial approaches
    - Include self-monitoring of stress intensity, thought record-keeping and rewriting, time management, assertiveness training and increased social interactions
- Systemic approach
    - Altering the factors which contribute to stress
    - Eg:switch a job role

f Explain Vroom's expectancy theory of motivation.

Vroom and colleagues identified three influences on motivation

- *Expectancy* – the belief that working harder leads to better performance
- *Instrumentality* – the belief that better performance will be rewarded
- *Perceived value*- of the resulting reward
- Motivation will be high when all three factors are high
- A zero level for any one of the factors can remove motivation
- Motivation=Expectancy x Instrumentality X Perceived value

5. Attempt *any three* of the following: **15**

a. Explain the advantages of a functional organization over project organization.

- Ease of staffing –Any number of required personnel can be brought into the project as needed, and they can be returned to the functional group when they complete their work.
- Production of good quality documents –since the team members working on some part of a project do not meet the developers who have completed other parts pf the poject and gone back to their functional teams.
- Job specialization –The functional organization structure facilitates developers to become to specialized in particular tasks such as database,networking,compilers,..
- Efficient handling of the problems associated with manpower turnover
- Career planning –makes it easier for a developer to have career that is technically oriented called technical ladder.

b. List the obstacles to good group decision making. Also explain Delphi decision making process.

The obstacles to good group decision making are

- Inter-personal conflicts
- Conflicts tend to be a dampened by emergence of *group norms* – shared group opinions and attitudes
- *Risky shift* – people in groups are more likely to make risky decisions than they would as individuals

In Delphi technique the following procedure is carried out:

- Enlist co-operation of experts
- Moderator presents experts with problem
- Experts send in their recommendations to the moderator
- Recommendations are collated and circulated to all experts
- Experts comment on ideas of others and modify their own recommendation if so moved
- If moderator detects consensus then the process is stopped, otherwise the comments are recirculated to the experts

c. Write short note on SEI capability maturity model.

- CMM is a reference model for appraising a software development organization into one of five process maturity levels
- Describes an evolutionary improvement path for software organizations from an ad hoc immature process :
    - To a mature, disciplined one.
- Provides guidance on:
    - How to control the process
    - How to evolve the process

CMM Level 1 (Initial)

- Organization operates Without any formalized process or project plans
- An organization at this level is characterized by Ad hoc and chaotic activities.
- Software development processes are not defined,
- Different developers follow their own process

Level 2 (Repeatable)

- Basic project management practices are followed
    - Size and cost estimation techniques:
    - Planning and tracking cost, schedule, and functionality
    - Configuration management tools to keep the deliverable items under configuration control
- Development process is ad hoc:Not formally defined, not documented.

Level 3 (Defined)

- All management and development activities Defined and documented.
- Common organization-wide understanding of activities, roles, and responsibilities
- Build up the capabilities of its employees through periodic training programs
- Systematic reviews are practiced to achieve phase containment of errors
- The process though defined:Process and product qualities are not measured.

Level 4 (Managed)

- Quantitative quality goals for products are set.
- Software process and product quality are measured:
- Detailed measures of the software process and product quality are collected
- Both the software process and products are quantitatively understood and controlled

Level 5 (Optimizing)

- Statistics collected from process and product measurements are analyzed:
  - Continuous process improvement based on the measurements.
- Lessons learned from specific projects incorporated into the process

d. What is reliability growth model? Explain any two reliability growth models.

- The reliability of a software product essentially denotes its *trustworthiness* or *dependability*.
- A reliability growth model (RGM) models how the reliability of a software product improves as failures are reported and bugs are corrected.
  - An RGM can be used to determine when during the testing phase a given reliability level will be attained, so that testing can be stopped
- Jelinski and Moranda Model
  - Step function model where it is assumed that the reliability increases by a constant increment each time an error is detected and repaired
  - All errors contribute equally to reliability growth
  - Instantaneous failure rate (hazard rate) ,
  - Z(t)=K(N-i) where K is a constsnt ,N is the total number of errors in the program and t is any time between the ith and (i+1)th failure
- Littlewood and Verall's Model
  - Negative reliability growth to reflect the fact that when a repair is carried out,it may introduce additional errors
  - As errors are repaired ,the average improvement to the product reliability per repair decreases
  - Error's contribution to reliability improvement to be an independent random variable using Gamma distribution
  - Error corrections with large contributions to reliability growth are removed first
- Goel-Okutomo Model
  - Execution time between failures are exponentially distributed
  - Cumulative number failures at any time can e given in terms of $\mu(t)$,the expected value of failures between t and $t+\Delta t$
  - Number of failures at time t can be given by
  - $\mu(t)=N(1-e^{-bt})$ N=no. of defects in code and b is the rate at which the failurre rate decreases

(Explain any two)

e. What are the steps of conducting a post implementation project review?

- Conduct project survey-The information is collected through a set of questionnaire that can bring out the important process and management issues that have a strong bearing on the success or failure of the project.
- Collect objective information
  - Post-mortem review --Collect project metrices like cost metrices,schedule metrices and quality metrices
  - Quantitative assessment
- Hold a debriefing meeting-To gain consensus on what was successful and what was not and identify the best practices and lessons learned.
- Final project review-Addresses various issues arising out of project planning and tracking, results of various phases ,risk management, configuration management and quality management.Guided by the information collected in debriefing meeting ,the project leaders determine the focus of review discusiion only on relevant topics.
- Prepare post-implementation review report.
- Publish the report.

f. Explain the different reason for which a project may need to be terminated.

Two reasons for closing a project are

- All project goals have been successfully accomplished
- Project is unlikely to achieve its stated objectives and has to be prematurely terminated

The reasons for prematurely terminating a project arre

- *Lack of resources Eg.Change in top management*
- *Changed business need of the customer*
- *Perceived benefits accruing from the project no longer remain valid Eg.Competing products*
- *Changes to the regulatory policies*
- *Key technologies used in the project becoming obsolete during project execution*
- *Risks have become unacceptably high*
    - *Eg. Unsettling company's financial soundness,inviting negative publicity*
