★ **What is the projects ?**

Project is a temporary endeavor undertaken to create a unique product or service.

Projects are temporary in nature and have a definite beginning and end date.

★ **Project Attributes**

➔ A project has a unique purpose.
➔ A project is temporary.
➔ A project involves uncertainty.
➔ A project is developed using progressive elaboration.
➔ A project requires resources, often from various areas.
➔ A project should have a primary customer or sponsor.

★ **The Triple Constraint**

1. **Scope goals:** What is the project trying to accomplish?
2. **Time goals:** How long should it take to complete? What is the project's schedule?
3. **Cost goals:** What should it cost to complete the project? What is the project's budget?

★ **What is Project Management ?**

Project management is "the application of knowledge, skills, tools, and techniques to project activities in order to meet project requirements".

Project management is the application of methodology, tools, and processes to effectively design and execute projects.

★ **Project management is processes such as**

1. Project initiation
2. Project planning
3. Project execution
4. Project monitoring and control
5. Project closure

★ **Advantages of Using Formal Project Management**

➔ Improved customer relations
➔ Improved productivity
➔ Lower costs
➔ Higher profit margins
➔ Shorter development times
➔ Higher quality and increased reliability
➔ Better control of financial, physical, and human resources
➔ Better internal coordination
➔ Higher worker morale

★ **Importance of Software Project Management**

➔ Software projects have more failure rate
➔ Final project is invisible until it ends
➔ Software Project use lot of effort, time , resources & money
➔ The need for Software projects keeps increasing

★ **What is Project Life Cycle?**

The Project Life Cycle is a framework that outlines the phases a project goes through from initiation to closure.

A project life cycle is a collection of project phases.

Five phases of project management life cycle :

1. Project Initiation
2. Project Planning
3. Project Execution
4. Project Monitoring and Control
5. Project Closure

★ **What is the Product Life Cycle?**

The Product Life Cycle is a concept in marketing that describes the stages a product goes through from its introduction to the market until its decline and eventual withdrawal.

1. Initiation
2. Planning
3. Development
4. Testing
5. Deployment
6. Maintenance

★ **Phases of the traditional project life cycle**

1. Concept
2. Development
3. Implementation
4. Close out

★ Difference between Product life cycle and Project Life Cycle

Product life cycle	Project life cycle
The product life cycle can have single or multiple projects.	The project life cycle has a single project.
A product life cycle is much longer than a project life cycle.	A project life cycle is much shorter than a product life cycle.
We must follow a sequence in the product life cycle.	We do not need to follow any sequence in the project life cycle.
A product life cycle focuses on the market's demands and competition.	A project life cycle focuses on the outcome as per the user requirements.

★ What is Project integration management ?

Project integration management involves coordinating all elements of a project, including tasks, resources, stakeholders, and deliverables.

★ What is Interface management ?

Interface management involves identifying and managing the points of interaction between various elements of the project.

★ Strategic Planning and Project Selection

Strategic planning involves determining long-term objectives, predicting future trends, and projecting the need for new products and services.

Organizations often perform a SWOT analysis:
– Strengths, Weaknesses, Opportunities, and Threats

As part of strategic planning, organizations should:
– Identify potential projects.
– Use realistic methods to select which projects to work on.
– Formalize project initiation by issuing a project charter.

★ Methods for selecting projects

➔ Performing net present value or other financial analyses.
➔ Focusing on broad organizational needs.
➔ Categorizing information technology projects.
➔ Using a weighted scoring model.
➔ Implementing a balanced scorecard.

★ Financial Analysis of Projects
Three primary methods for determining the projected financial value of projects:

1. Net present value (NPV) analysis
2. Return on investment (ROI)
3. Payback analysis

1. Net present value (NPV) analysis

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

Projects with a positive NPV should be considered if financial value is a key criterion. The higher the NPV, the better.

2. Return on investment (ROI)

Return on investment (ROI) is calculated by subtracting the project costs from the benefits and then dividing by the costs.

$$ROI = \frac{(total\ discounted\ benefits - total\ discounted\ costs) * 100}{discounted\ costs}$$

The higher the ROI, the better.

3. Payback Analysis

The payback period is the time it takes to recover the initial investment in a project through net cash inflows.

Payback occurs when the cumulative discounted benefits and costs are greater than zero.

★ Weighted Scoring Model

A weighted scoring model is a tool that provides a systematic process for selecting projects based on many criteria.

★ Balanced Scorecard

A balanced scorecard is a methodology that converts an organization's value drivers, such as customer service, innovation, operational efficiency, and financial performance, to a series of defined metrics.

★ Project Charters

A project charter is a document that formally recognizes the existence of a project and provides direction on the project's objectives and management.

★ What is Scope Statements ?

A scope statement is a document used to develop and confirm a common understanding of the project scope.

★ What is project management plan ?

A project management plan is a document used to coordinate all project planning documents and help guide a project's execution and control.

★ **Major project scope management processes**

1. Initiation
2. Scope Planning
3. Scope Definition
4. Scope Verification
5. Scope Change Control

★ **What is Project Scope Management ?**

Project scope management includes the processes involved in defining and controlling what is or is not included in a project.

★ **Project Scope Management Processes**

1. **Scope planning:** Deciding how the scope will be defined, verified, and controlled.
2. **Scope definition:** Reviewing the project charter and preliminary scope statement and adding more information as requirements are developed and change requests are approved.
3. **Creating the WBS:** Subdividing the major project deliverables into smaller, more manageable components.
4. **Scope verification:** Formalizing acceptance of the project scope.
5. **Scope control:** Controlling changes to project scope.

★ **What is The scope management plan ?**

The scope management plan outlines how the project team will prepare the project scope statement, create the WBS, verify project deliverables, and manage scope change requests.

★ **What is the project charter ?**

A project charter is a document that formally recognizes the existence of a project and provides direction on the project's objectives and management.

★ **What is Work Breakdown Structure (WBS) ?**

A WBS is a deliverable-oriented grouping of the work involved in a project that defines the total scope of the project.

★ **Project time management**

Project time management involves the processes required to ensure timely completion of a project.

The major processes in developing the project time schedule are

1. Activity definition
2. Activity sequencing
3. Activity duration estimating
4. Schedule development
5. Schedule control

Tools and technique in time management\

- ➔ Gantt charts,
- ➔ project network diagrams,
- ➔ critical path analysis,
- ➔ crashing,
- ➔ fast tracking,
- ➔ schedule performance measurements etc

★ What is a milestone ?

A milestone is a significant event that normally has no duration.

They're useful tools for setting schedule goals and monitoring progress

★ dependency or relationship ?
A dependency or relationship is the sequencing of project activities or tasks.

There are three basic reasons for creating dependencies among project activities.

1. **Mandatory dependencies.**

    Mandatory dependencies are inherent in the nature of the work being performed on a project. They are sometimes referred to as hard logic.

    For example, you cannot test code until after the code is written.

2. **Discretionary dependencies.**

    Discretionary dependencies are defined by the project team.

    For example, a project team might follow good practice and not start the detailed design of a new information system until the users sign off on all of the analysis work. Discretionary dependencies are sometimes referred to as soft logic and should be used with care because they may limit later scheduling options.

3. **External dependencies.**

    External dependencies involve relationships between project and non-project activities.

    For example, the installation of a new operating system and other software may depend on delivery of new hardware from an external supplier. Even though delivery of the hardware may not be included in the scope of the project, you should add an external dependency to it because late delivery will affect the project schedule

★ Network Diagrams

A network diagram is a visual representation showing the logical order and relationships between activities in a project.

A network diagram is a schematic display of the logical relationships among or sequencing of project activities.

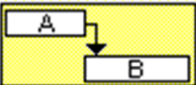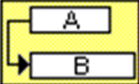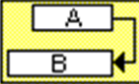There are 2 methods used for developing Network Diagrams.

1. Arrow Diagramming Method (ADM) or Activity-on-Arrow (AOA)
2. Precedence Diagramming Method (PDM) or Activity on node diagrams.

★ **Task Dependency Types MS Projects**

1. **Finish-to-Start (FS):** Task (B) cannot start until task (A) finishes.
2. **Start-to-Start (SS):** Task (B) cannot start until task (A) starts.
3. **Finish-to-Finish (FF):** Task (B) cannot finish until task (A) finishes.
4. **Start-to-Finish (SF):** Task (B) cannot finish until task (A) starts.

Task dependencies

The nature of the dependencies between linked tasks. You link tasks by defining a dependency between their finish and start dates. For example, the "Contact caterers" task must finish before the start of the "Determine menus" task. There are four kinds of task dependencies in Microsoft Project:

Task dependency	Example	Description
Finish-to-start (FS)	A → B	Task (B) cannot start until task (A) finishes.
Start-to-start (SS)	A → B	Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)	A → B	Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)	A → B	Task (B) cannot finish until task (A) starts.

★ **Gantt charts**

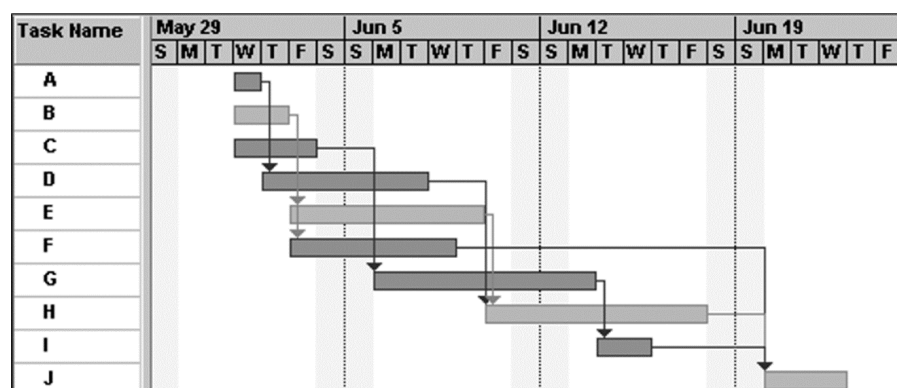A Gantt chart is a project management tool that illustrates a project plan.

Gantt charts display project schedules by listing activities with their start and finish dates in a calendar format.

Symbols include:
➔ **A black diamond:** milestones or significant events on a project with zero duration
➔ **Thick black bars:** summary tasks
➔ **Lighter horizontal bars:** tasks
➔ **Arrows:** dependencies between tasks

★ Critical Path Method (CPM)

CPM is a project network analysis technique used to predict total project duration.

The critical path is the longest path through the network diagram.

★ Precedence Diagramming Method (PDM) or Activity on node diagrams(AON)

ES	D	EF
	A	
LS	TF	LF

ES = Early start (Earliest date an activity can be started)
EF = Early finish (Earliest date an activity can be completed)
LS = Late start (Latest date an activity can start)
LF = Late finish (Latest date an activity can be completed)
D = Duration (Duration of the activity)
TF = Total Float (Amount of time the activity can be delayed without delaying without delaying the finish date of the project)

EF = ES + D
LS = LF - D
TF =   LF - EF   or
**   LS - ES**

Free flout = ES of succeeding activity - EF of given activity
Span = Duration + Flout

★ Program Evaluation and Review Technique (PERT)

PERT is a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates.

The Program Evaluation and Review Technique (PERT) is used to find the estimated time for activities to be completed when there are many unknown factors.

PERT weighted average formula

$$PERT_{\text{Beta Distribution}} = \frac{O + 4M + P}{6}$$

O = optimistic time
M = most likely time
P = pessimistic time

★ **What is Project cost management ?**

Project cost management is the process required to ensure that the project is completed within an approved budget.

★ **Project cost management process**

1. Cost estimating
2. Cost budgeting
3. Cost control

★ **Basic Principles of Cost Management**

Profits are revenues minus expenses
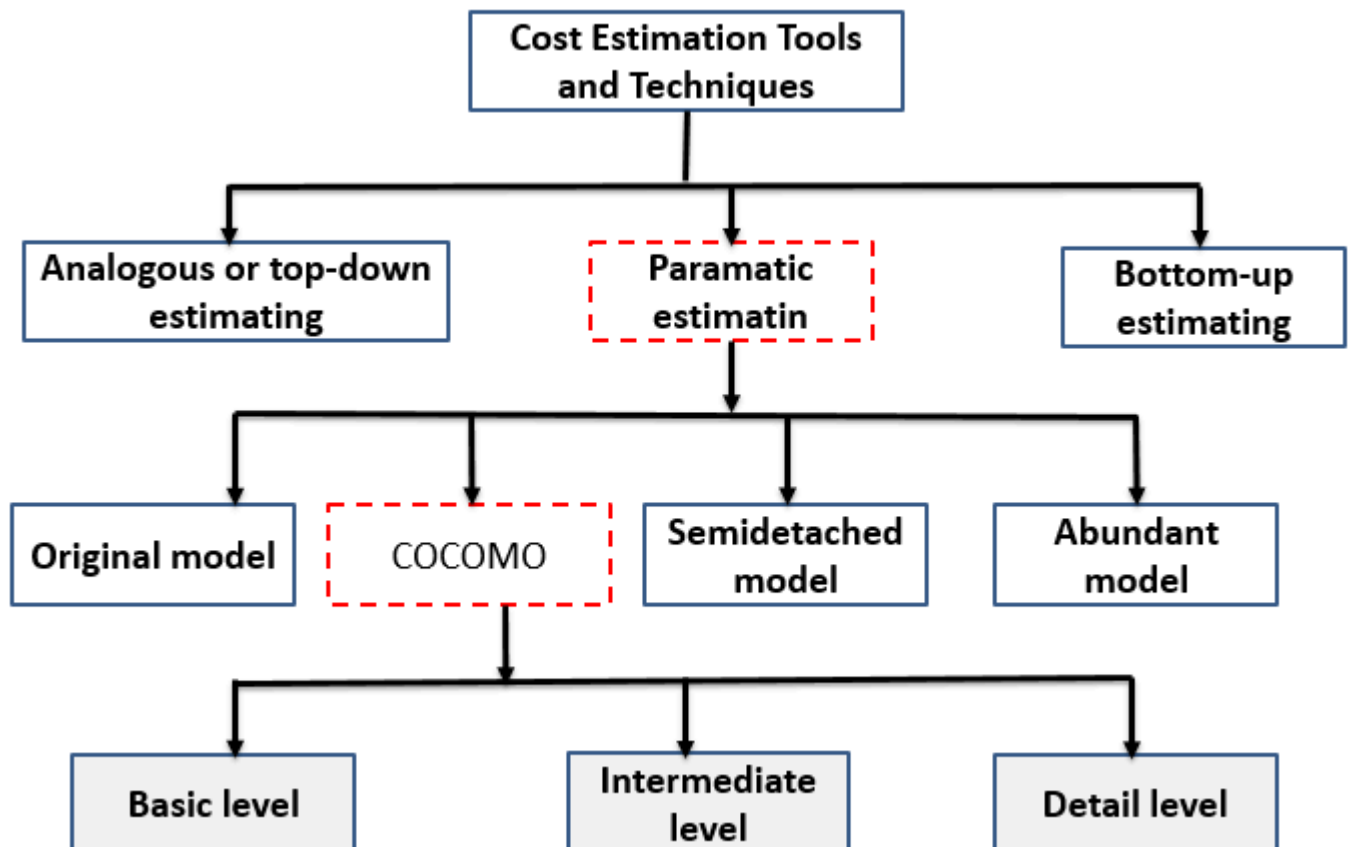
Profits =revenues – expenses

Life cycle costing is estimating the cost of a project plus the maintenance costs of the products it produces

Life cycle costing = cost of a project + maintenance costs of the product it produces

★ **Cash flow analysis**

Cash flow analysis is determining the estimated annual costs and benefits for a project.

★ **Cost Estimation Tools and Techniques**

```
                      ┌──────────────────────┐
                      │ Cost Estimation Tools │
                      │    and Techniques     │
                      └──────────────────────┘
         ┌────────────────────┬──────────────────────┐
┌────────────────────┐ ┌────────────────┐ ┌──────────────────┐
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│  Basic level │ │ Intermediate │ │ Detail level │
│              │ │    level     │ │              │
└──────────────┘ └──────────────┘ └──────────────┘
```

★ Constructive Cost Model (COCOMO)

The Cocomo Model is a procedural cost estimate model for software projects and is often used as a process of reliably predicting the various parameters associated with making a project such as size, effort, cost, time, and quality.

The Cocomo Model is a method used to estimate the cost, effort, and time required for software projects.

Hierarchy of software estimation model

1. Basic Model
2. Intermediate Model
3. Detailed Model

1. Basic COCOMO Model:

Mode	a	b	c	d
Organic	2.4	1.05	2.5	0.38
semi - detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Effort = a x (KLOC)^b , unit = person months

Development Time = c x (Effort)^d , unit = months

Average Staff Size = (Effort) / Development Time , unit = persons

Productivity = (KLOC) / (Effort) , unit = kloc/person months

Q1: Suppose a project was estimated to be 400 KLOC (kilo lines of codes). Calculate the effort and development time for each of the three models i.e., organic, semi-detached & embedded.

Answer -

(i) Organic Mode

$$\text{Effort} = a \times (KLOC)^b$$
$$2.4 * (400)^{1.05}$$
1295.31 PM

$$\text{Development Time} = c \times (Effort)^d$$
$$2.5 * (1295.31)^{0.38}$$
38.07 Months
38 months

(ii) Semi Detached Mode

Effort = a x (KLOC)^b

$3.0 * (400)^{1.12}$

2462.79 PM

Development Time = c x (Effort)^d

$2.5 * (2462.79)^{0.35}$

38.45 Months

(iii) Embedded Mode

Effort = a x (KLOC)^b

$3.6 * (400)^{1.20}$

4772.81 PM

Development Time = c x (Effort)^d

$2.5 * (4772.8)^{0.32}$

38 Months

Q2: A development project is size of 7.5 kloc and evaluated as being simple.find the value for average staff productivity.

Answer -

(i) Organic Mode

Effort = a x (KLOC)^b

$2.4 * (7.5)^{1.05}$

19.20 PM

20 PM

Development Time = c x (Effort)^d

$2.5 * (20)^{0.38}$

7.80 Months

8 Months

Average Staff Size = (Effort) / Development Time

20 / 8

2.5 persons

3 persons

Productivity = (KLOC) / (Effort)

7.5 / 20

0.375 kloc/person months

2. Intermediate COCOMO Model:

Parameters	a	b	c	d
Organic	2.4	1.05	2.5	0.38
semi - detached	3.0	1.12	2.5	0.35
Embedded	2.8	1.20	2.5	0.32

Effort = a x (KLOC)^b x EAF (Effort adjustment factor)

Development Time = c x (Effort)^d , unit = months

Cost Drivers	RATINGS					
	Very low	Low	Nominal	High	Very High	Extra High
Product Attributes						
RELY	0.75	0.88	1.00	1.15	1.40	..
DATA	..	0.94	1.00	1.08	1.16	..
CPLX	0.70	0.85	1.00	1.15	1.30	1.65
Computer Attributes						
TIME	..	..	1.00	1.11	1.30	1.66
STOR	..	..	1.00	1.06	1.21	1.56
VIRT	..	0.87	1.00	1.15	1.30	..
TURN	..	0.87	1.00	1.07	1.15	..

Cost Drivers	RATINGS					
	Very low	Low	Nominal	High	Very high	Extra high
Personnel Attributes						
ACAP	1.46	1.19	1.00	0.86	0.71	..
AEXP	1.29	1.13	1.00	0.91	0.82	..
PCAP	1.42	1.17	1.00	0.86	0.70	..
VEXP	1.21	1.10	1.00	0.90	..	..
LEXP	1.14	1.07	1.00	0.95	..	..
Project Attributes						
MODP	1.24	1.10	1.00	0.91	0.82	..
TOOL	1.24	1.10	1.00	0.91	0.83	..
SCED	1.23	1.08	1.00	1.04	1.10	..

- **Classification of Cost Drivers and their attributes:**
- **Product attributes**
  - Required software reliability extent(RELY)
  - Size of the application database(DATA)
  - The complexity of the product(CPLX)
- **Hardware attributes**
  - Run-time performance constraints(TIME)
  - Memory constraints(STOR)
  - The volatility of the virtual machine environment(VIRT)
  - Required turnabout time(TURN)
- **Personal attributes −**
  - Analyst capability(ACAP)
  - Software engineering capability(AEXP)
  - Applications experience(PCAP)
  - Virtual machine experience(VEXP)
  - Programming language experience(LEXP)
- **Project attributes**
  - Use of software tools(MODP)
  - Application of software engineering methods(TOOL)
  - Required development schedule(SED)

Attributes: −

PRODUCT = RELY * DATA * CPLX

COMPUTER = TIME * STOR * VIRT * TURN

PERSONNEL = ACAP * AEXP * PCAP * VEXP * LEXP

PROJECT = MODP * TOOL * SCED

Q1: A New project with estimated 400 KLOC embedded system has to be developed project mangers has a choice of hiring from 2 pools of developers very highly capable with app and very little experience in programming language or developers of low quality but a lot of programing language experience which is better choice in terms of 2 pools?

Answer-

Case 1

EAF = (AEXP) x (LEXP)

0.82 x 1.14

0.934

E = a x (KLOC)^b x EAF

2.8 x (400)$^{1.20}$ x 0.934

3470 PM

Tdev = c x (Effort)^d

2.5 x (3470)$^{0.32}$

33.9 Month

Case 2

EAF = (AEXP) x (LEXP)

1.29 x 0.95

1.22

E = a x (KLOC)^b x EAF

2.8 x (400)$^{1.20}$ x 1.22

4528.86 PM

Tdev = c x (Effort)^d

2.5 x (4528.86)$^{0.32}$

36.97 Month

Case 1 team is more suitable.

★ **Earned Value Management (EVM)**

EVM is a project performance measurement technique that integrates scope, time, and cost data.

Table 7-7: Earned Value Calculations for One Activity After Week One

ACTIVITY	WEEK 1
Earned Value (EV)	7,500
Planned Value (PV)	10,000
Actual Cost (AC)	15,000
Cost Variance (CV)	–7,500
Schedule Variance (SV)	–2,500
Cost Performance Index (CPI)	50%
Schedule Performance Index (SPI)	75%

Table 7-8: Earned Value Formulas

TERM	FORMULA
Earned value	EV = PV to date X percent complete
Cost variance	CV = EV – AC
Schedule variance	SV = EV – PV
Cost performance index	CPI = EV/AC
Schedule performance index	SPI = EV/PV
Estimate at completion (EAC)	EAC = BAC/CPI
Estimated time to complete	Original time estimate/SPI

★ **What is Cost Budgeting ?**

Cost budgeting involves allocating the project cost estimate to individual work items over time.

★ **Project Communications Management ?**

Project Communications Management includes the processes required to ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information.

Number of communications channels = n (n-1) / 2
where n is the number of people involved.

★ **Project Communications Management Processes**

1. **Communications planning:** Determining the information and communications needs of the stakeholders.
2. **Information distribution:** Making needed information available to project stakeholders in a timely manner.
3. **Performance reporting:** Collecting and disseminating performance information, including status reports, progress measurement, and forecasting.
4. **Managing stakeholders:** Managing communications to satisfy the needs and expectations of project stakeholders and to resolve issues.

★ **Suggestions for Improving Project Communications.**

1. Manage conflicts effectively.
2. Develop better communication skills.
3. Run effective meetings.
4. Use email effectively.
5. Use templates for project communications.

★ **What is Communications Infrastructure ?**

A communications infrastructure is a set of tools, techniques, and principles that provide a foundation for the effective transfer of information.

★ **What is Risk ?**

Project risk involves understanding potential problems that might occur on the project and how they might impede project success.

★ **Risk Management**

Risk Management is the systematic process of identifying, analyzing, and responding to project risk.

The major processes in Project Risk Management :
1. Risk Management Planning
2. Risk Identification
      Several risk identification tools and techniques include
      ● Brainstorming
      ● The Delphi technique
      ● Interviewing
      ● SWOT analysis
3. Qualitative Risk Analysis
4. Quantitative Risk Analysis
5. Risk Response Planning
      Four main strategies:
      1. **Risk avoidance:** eliminating a specific threat or risk, usually by eliminating its causes
      2. **Risk acceptance:** accepting the consequences should a risk occur
      3. **Risk transference:** shifting the consequence of a risk and responsibility for its management to a third party
      4. **Risk mitigation:** reducing the impact of a risk event by reducing the probability of its occurrence
6. Risk Monitoring and Control

This short note making resources are,google search engine,chat gpt and lecture slides
WhatsApp group (click on this/new syllabus notes only)   Credit - Kanishka viraj

★ Agile model of software development

Agile model of software development means using a method based on iterative and incremental development.

★ What is scrum ?

Scrum is the leading agile development method for completing projects with a complex, innovative scope of work.

Q1) Network diagram question and answer

📄 **Network diagram Question.pdf**

📄 **Network diagram Answer.pdf**

Q2) Evaluating Investment Projects Using NPV, ROI, and Payback Method Question and answer.

📄 **Evaluating Investment Projects Using NPV, ROI, and Payback Method Question.pdf**

📄 **NPV , ROI Answer.pdf**