UNIT-4 [Around 10 marks]

Risk Management

⊛ Introduction:

A risk is a potential problem which might happen or which might not happen. Risk concerns future happenings. It involves change in mind, opinion, actions, places etc.

Two main characteristics of risk are:

i) Uncertainity: the risk may or may not happen, that is there are no 100% risks.

ii) Loss: If risks become a reality then losses occur.

⊛ Nature of risk: There are 3 main classifications of risks that can affect software project: [Risk Types] [Imp].

→ If more than 3 marks asked we can explain internal terms in short like schedule risk, budget risk etc.

i) Project risk: It concerns topics like budget, schedule, personnel, resource and customer related problems. Since the project is intangible, it is very tough to monitor and control it.

ii) Technical risk: It concerns potential method, implementation, testing and maintenance issues as well as technical uncertainity. This risk occurs due to insufficient knowledge about technology and project.

iii) Business risk: It contains risks of building an excellent product that no one need, losing budgetary, or communication etc.

⊛ Identification of risk: [Imp]

Identification of risk is one of the critical step in risk management. By chance, if failure occurs in identifying any particular risk, then all other steps that are involved in risk management will not be implemented for that particular task. To manage risk, project team or organization should be able to know what risks the project might face and then how to evaluate those risks. Following are the methods for identifying risks:

i) **Checklist Analysis:** It is a technique for identifying and managing risks in which the checklist is developed by listing items, steps, tasks, then further analysed against provided criteria of risks.

ii) **Brainstorming:** It provides free and open approach that usually encourage each and everyone on project team to participate. It is used to determine best possible solution to problems as well as issues that arises.

iii) **Casual Mapping:** It is a method that builds on reflection and review failure factors in cause and effect of the diagrams. A best keytool for risk judgement.

iv) **SWOT Analysis (Strengths - Weakness - Opportunities - Threat Analysis):**
SWOT is a very helpful technique for identifying risks within greater organization. It is basically used for formulation of strategies for project. It helps to find out weaknesses and threats.

v) **Flowchart Method:** This method allows for dynamic process to be diagramatically represented on paper. It is generally used to represent activities of process graphically and sequentially to simply find the risk.

⊛ **Risk Analysis:**
Risk analysis in project management is a sequence of processes to identify the factors that may affect a project's success. This process includes risk identification (already discussed), analysis of risks and management of risks. Risk analysis helps to control possible future events that may harm overall project. It is a pro-active process.

During risk analysis we perform following steps:
1. Identifying the problems causing risk in projects.
2. Identifying the probability of occurance of problems.
3. Identifying the impact of problem.

4. Assign value to step 2 and 3 in range of 1-100 as (0-10) very low, (10-25) low, (25-50) moderate, (50-75) high, (75-100) very high.

5. Calculate risk exposure factor as:

$$RE = (\text{potential damage}) * (\text{probability of occurrence})$$

i.e, Step3 × Step2.

where, potential value: a money value.
for e.g: flood caused damage of 15 crores.
probability: ranges from 0.00 to 1.00
for e.g: 0.1 (ten time in hundred chances).

6. Prepare table consisting of all of these values and order risk on the basis of risk exposure factor (RE).

Example:

Risk	Problem	Probability of occurrence	Impact of problem	Risk Exposure	Priority
R_1	Issue of incorrect password	2	2	4	R_2
R_2	Design is not Robust	2	7	14	R_1

Risk Avoidence and Mitigation: The purpose of this technique is to altogether eliminate the occurrence of risks. So to avoid risks this method reduces the scope of projects by removing non-essential requirements.

Risk Monitoring: Here, the risk is monitored continuously by re-evaluating the risk, the impact of risk, and the probability of risk. It ensures that:
→ Risk has been reduced.
→ New risks are discovered.
→ Impact and magnitude of risks are measured.

⊛ Evaluation of risk to the schedule using Z-values: [Imp]

Important related formulas: ← Same... these are already discussed in unit 3 in PERT also

1) Expected time = $\dfrac{\text{optimistic time} + 4 \times (\text{most likely time}) + \text{Pessimistic Time}}{6}$

i.e, $\boxed{T_e = \dfrac{t_o + 4t_m + t_p}{6}}$

2) Variance = $\left(\dfrac{\text{Pessimistic time} - \text{Optimistic time}}{6}\right)^2$

i.e, $\boxed{\sigma^2 = \left(\dfrac{t_p - t_o}{6}\right)^2}$

3) Z-value = $\dfrac{\text{Scheduled Time} - \text{Expected Time}}{\text{Standard deviation }(\sigma)\text{ of critical path}}$

i.e, $\boxed{Z = \dfrac{T_s - T_e}{\sigma}}$

→ youtube Link: https://youtu.be/ClayGimadCg
if any confusion otherwise easy

Q.

Activity	Optimistic	Most likely	Pessimistic
1-2	4	10	16
1-3	3	6	9
1-4	4	7	16
2-5	5	5	5
3-5	8	11	32
4-6	4	10	16
5-6	2	5	8

*i.e question point पर directly पहुँच जाओ question पढ़ते ही direct process follow करना

* Draw the network diagram.
ii) Identify the critical path and its duration. ← → last IV step में यही पूँछा question आता है but पूँछा तो step एक ही process follow करो becoz step ① directly पूँछा होता
iii) What is the probability that the project will be completed in 5 days earlier than critical path duration?
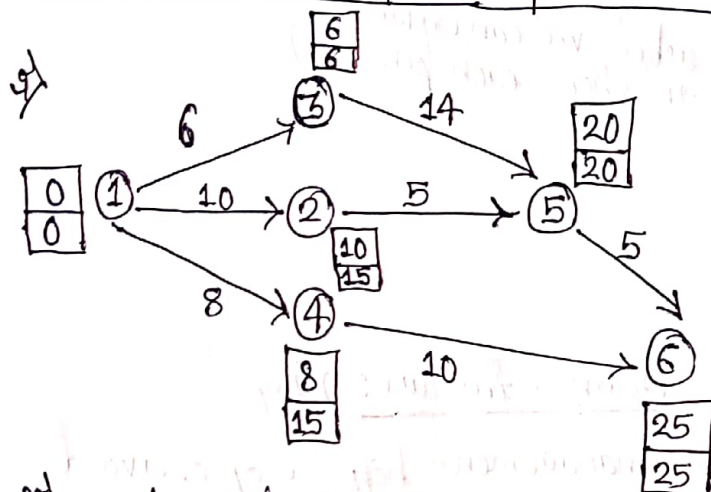iv) What project duration will provide 95% confidence level of completion?

Solution: ← आगे नक्शा बनाने process same PERT के है same

Activity	Time Estimates (Days)			Expected Time $t_e = \dfrac{t_0 + 4t_m + t_p}{6}$	Variance $\sigma^2 = \left(\dfrac{t_p - t_0}{6}\right)^2$
	t_0	t_m	t_p		
1-2	4	10	16	10	4
1-3	3	6	9	6	1
1-4	4	7	16	8	4
2-5	5	5	5	5	0
3-5	8	11	32	14	16
4-6	4	10	16	10	4
5-6	2	5	8	5	1

Earliest Time / Latest Time

II) ~~Critip~~ Critical Path is: $1 \xrightarrow{6} 3 \xrightarrow{14} 5 \xrightarrow{5} 6$

Therefore duration = 6 + 14 + 5

= 25 days ← → T_e: expected time

→ in table for activity 1-3 variance is 1 similarly for others

Variance (σ^2) = 1 + 16 + 1

= 18

$\sigma = \sqrt{18}$

∴ Standard deviation = 4.24

→ we have critical path duration as 25 days in m(II).
In question 5 days earlier said so 25 - 5 = 20 days will be T_s

III) Now, we calculate Z value as:

$$Z = \frac{T_s - T_e}{\sigma} = \frac{20 - 25}{4.24} = -1.18$$

decimal to percent

So, Z = -1.18

Now, from Z-value table value for -1.1 row and .08 column is 0.1190

∴ Probability = 11.9 %

iv) Given 95% confidence, so, from z-value table, the value for 0.95 is 1.65. (i.e, z=1.65).

So, using formula, $z = \dfrac{T_S - T_e}{\sigma}$

or, $1.65 = \dfrac{T_S - 25}{4.24}$

or, $T_S = 31.97$ days.

(→ यो value हेर्दा table को बिचमा हेर्दै 0.9505 होला त्यसको row 1.6 र column 0.05 so value is 1.65)

Hence, Project duration for 95% level of confidence is 31.97 days

❀ **Risk Management Process:**

(→ if asked we can explain in short each point)

i) Identification of risk.
ii) Analysis of risk.
iii) Evaluate or Rank the risk.
iv) Treat the Risk.
v) Monitor and Review the risk.

❀ **Boehm's Risk engineering break down structure: [Imp]**

Boehm believes that, "Risk management helps people avoid disasters, rework and simulate win-win situation on software projects. Bohem's software risk management focuses on the concept of "risk exposure" as defined by the relationship where the probability of unsatisfactory outcome and loss determine the volume of risk event."

Risk Management
↓
├── **Risk assessment**
│   ├── **Risk Identification**
│   │   → Checklist
│   │   → Assumption analysis
│   │   → Decomposition
│   │   → Decision Driver analysis.
│   ├── **Risk Analysis**
│   │   → Performance models
│   │   → Cost models
│   │   → Network analysis
│   │   → Decision analysis
│   └── **Risk prioritisation**
│   → Risk Leverage
│   → Risk Exposure
│
└── **Risk Control**
    ├── **Risk Management Planning**
    │   → Risk Avoidance
    │   → Risk Transfer
    │   → Risk Reduction
    │   → Risk Plan integration
    ├── **Risk Resolution**
    │   → Prototypes
    │   → Simulation
    │   → Analysis
    │   → Staffing
    └── **Risk Monitoring**
        → Milestone tracking
        → Corrective action