

Part 1:

Phase		Work Size	Productivity
Project Plan			
	Write Plan	182 pages	4 pages/hr
	Review		
	Preparation for review	182 pages	4 pages/hr
	Review meeting	182 pages	8 pages/hr
	Rework	176 defects	6 defects/hr
Process Updates			
	Process Changes	78 changes	5 changes/hr
	Review Changes		
	Preparation for review	78 changes	5 changes/hr
	Review Meeting	78 changes	10 changes/hr
	Rework	87 defects	4 defects/hr
Requirements			
	Write requirements	189 req	5 req/hr
	Review requirements		
	Preparation for review	189 req	12 req/hr
	Review Meeting	189 req	18 req/hr
	Rework	195 defects	7 defects/hr
Build the development and testing lab environment			
	Hardware Environment		
	Servers	13	1 server/day
	Clients	19	5 clients/day
	Software Development Tools		
	Build/Compile Tools	10	1 tool/hr
	Software Testing Tools		
	Test Cases Execution tools	5	2 tool/day
	Simulation tools	8	2 tool/day
Analysis			

	Write Analysis Documentation	143 pages	4 pages/hr
	Review Analysis Document		
	Preparation for Analysis Document	143 pages	4 pages/hr
	Review Meeting	143 pages	9 pages/hr
	Rework	160 defects	5 defects/hr
Design			
	Write DD	189 pages	5 pages/hr
	Review DD		
	Preparation for DD	189 pages	4 pages/hr
	Review Meeting	189 pages	8 pages/hr
	Rework	200 defects	5 defects/hr
Coding			
	Write Code	4100 SLOC	6 SLOC/hr
	Unit Testing		
	Prepare/Execute Test Cases	361 test cases	4 testcase/hr
	Fix Found Defects	300 defects	11 defects/day
	Test Fixed Defects	300 defects	11 defects/day
	Code Inspection		
	Preparation for Code Inspection	4100 SLOC	85 SLOC/hr
	Code Inspection Meeting	4100 SLOC	165 SLOC/hr
	Rework	308 defects	5 defects/hr
Testing			
	Write test plan (TP)	167 pages	10 pages/day
	Review TP		
	Preparation for TP	167 pages	5 pages/hr
	Review TP Meeting	167 pages	10 pages/hr
	Rework	96 defects	4 defects/hr
	Execute TP (test cases)	178 test cases	10 testcases/day
	Fix Found Defects	81 defects	5 defects/day
	Test Fixed Defects	81 defects	8 defects/day
Documentation			
	User Documentation	233 pages	5 pages/hr
	Review UD		

	Preparation for UD Review	233 pages	5 pages/hr
	Review UD Meeting	233 pages	9 pages/hr
	Rework	338 defects	6 defects/hr

Calculations:

1. **Project Plan:** Given work size= 182 pages

1. **Write Plan:**

Productivity rate = (2 pages/Hour + 5pages/Hour)/2 = 7/2 = 3.5 =4 pages/Hour.

2. Review Plan:

Preparation for review:

Productivity rate = (3 pages/Hour + 4pages/Hour)/2 = 7/2 = 3.5 =4 pages/Hour.

Review Meeting:

Productivity rate = (10 pages/Hour + 5 pages/Hour)/2 = 15/2 = 7.5 =8 pages/Hour.

3. Rework:

Productivity rate= (7 pages/Hour + 5 pages/Hour)/2 = 12/2 =6 pages/Hour.

Work size =

1st project = (32*1000)/51= 627.4 = 628

2nd project = (156* 1000)/120 = 1300

Avg = 1928/2 = 964

Cal = 964 * 0.182 = 175.4 = 176 defects.

2. Requirements: Given work size= 189 Req

1. Write Requirements:

Productivity rate= (4 Req/Hour + 5 Req/Hour)/2 = 9/2 =4.5 =5 Req/Hour.

2. Review Plan:

Preparation for review:

Productivity rate= (18 Req/Hour + 5 Req/Hour)/2 = 23/2 =12 Req/Hour.

Review Meeting:

Productivity rate= (28 Req/Hour + 8 Req/Hour)/2 = 36/2 =18 Req/Hour.

Rework:

Productivity rate = 10+4/2 = 7 pages/hour

Work size=

1st project = (189*1000)/167 = 1131.7 = 1132

2nd project =(378* 1000)/410 = 922

Avg = 2054/2 = 1027

Cal = 1027 * 0.189 = 194.1 = 195

3. Analysis: Given work size= 143 Pages

1. write analysis document

Productivity rate= (4pages/Hour + 3 pages/Hour)/2 = 7/2 =4 pages/Hour.

3. Review analysis document

- a. Preparation for analysis document

- i. Productivity rate= (4pages/Hour + 4 pages/Hour)/2 = 8/2 =4 pages/Hour.

- ii. Review meeting = (9+8)/2 =17/2=9pages/hour

rework:

productivity rate = $5 + 5 / 2 = 5$ page/hour

Work size=

1st project= $123 * 1000 / 89 = 1382$

2nd project= $343 * 1000 / 403 = 852$

Avg = $2234 / 2 = 1117$

Cal = $1117 * 0.143 = 159.7 = 160$ defects

4. Design : given work size 189 pages

Write DD

Productivity rate = $5 + 4 / 2 = 9 / 2 = 5$ pages/ hour

Review DD

Preparation for DD

Productivity rate = $4 + 4 / 2 = 8 / 2 = 4$ pages/hour

Review meeting = $8 + 8 / 2 = 8$ pages/hour

Rework

Productivity rate = $5 + 4 / 2 = 5$ defects/ hour

Worksize=

1st project = $231 * 1000 / 184 = 1256$

2nd project= $343 * 1000 / 403 = 852$

Avg = $2108 / 2 = 1054$

Calculation = $1054 * 0.189 = 199.2 = 200$ defects

5. Coding= given work size = 4100sloc

Write code

Productivity rate= $6 + 5 / 2 = 11 / 2 = 6$ sloc/hour

Unit testing:

Prepare or execute testcases:

Productivity rate= $5 + 1.25 / 2 = 6.25 = 4$ pages/hour

Work size

1st project = $317 * 1000 / 5123 = 61.8 = 62$

2nd project = $945 * 1000 / 8420 = 112.2 = 113$

Avg = $175 / 2 = 87.5 = 88$

Cal = $88 * 4.1 = 360.8 = 361$ testcases

Fixed found defects

Productivity rate = $13 + 8 / 2 = 21 / 2 = 11$ defects / day

Work size

1st project = $271 * 1000 / 5123 = 52.8 = 53$

2nd project = $783 * 1000 / 8420 = 92.9 = 93$

Avg= $146 / 2 = 73$

$$\text{Cal} = 73 * 4.1 * 299.3 = 300 \text{ defects}$$

Test fixed defects

$$\text{Productivity rate} = 10 + 12 / 2 = 11 \text{ defects / day}$$

Code inspection

Prepare for code inspection

$$\text{Productivity rate} = 70 + 100 / 2 = 170/2 = 85 \text{ sloc/hour}$$

Code inspection meeting

$$\text{Productivity rate} = 120 + 210 / 2 = 165 \text{ sloc/hour}$$

Rework

$$\text{Productivity rate} = 5 + 5 / 2 = 5 \text{ defects/ hour}$$

Work size

$$1^{\text{st}} \text{ project} = 195 * 1000 / 5123 = 38$$

$$2^{\text{nd}} \text{ project} = 935 * 1000 / 8420 = 111$$

$$\text{Avg} = 149 / 2 = 74.5 = 75$$

$$\text{Cal} = 75 * 4.1 = 307.5 = 308 \text{ defects}$$

6. Documentation

Given work size = 233 pages

User documentation

$$\text{Productivity rate} = 5 + 4 / 2 = 9 / 2 = 5 \text{ pages/hour}$$

Review UD

Preparation for UD review

$$\text{Productivity rate} = 5 + 4 / 2 = 5 \text{ pages/ hour}$$

Review UD meeting

$$\text{productivity rate} = 7 + 10 / 2 = 9 \text{ pages/hour}$$

rework

$$\text{productivity rate} = 5 + 6 / 2 = 6 \text{ defects/hour}$$

work size=

$$1^{\text{st}} \text{ project} = 283 * 1000 / 146 = 1938.3 = 1939$$

$$2^{\text{nd}} \text{ project} = 490 * 1000 / 510 = 961$$

$$\text{Avg} = 2900 / 2 = 1450$$

$$\text{Cal} = 1450 * 0.233 = 338 \text{ defects}$$

7. What is the earliest finish date for this project if it is scheduled to start on 3/4/24?

Ans : 8/26/24

8. Can this project be completed 2 months after it starts? Explain why yes or no.

This project can not be completed within 2 months after it starts. Reason being, if we look at the write code task, though we are assigning 5 programming engineers, it is finishing in 47 days which is closer to 2 months already. If we make unrealistic assumptions for choosing the number of resources, it'd create illogical possibilities for project completion. Overall, it is not possible for this project to finish two months after its starting date.

10.

1. Document and Comment on the WBS

The Work Breakdown Structure (WBS) effectively organizes the project into manageable sections, making it easier to allocate resources, manage tasks, and track progress. The hierarchical decomposition of the project into phases, deliverables, and work packages, as seen in the detailed breakdown, allows for a clear view of the project scope. Each element is numbered systematically (e.g., 1.1.1, 1.1.2), facilitating easy reference and alignment with the project plan. However, ensuring that each component of the WBS is mutually exclusive and collectively exhaustive is crucial to avoid overlap and ensure coverage of all necessary work.

2. Document and Comment on the Network Diagram

Network Diagrams are essential for visualizing the sequence of tasks, their dependencies, and critical path(s) within a project. By illustrating tasks (nodes) and their dependencies (edges), project managers can identify the most time-critical activities that could impact the project timeline. For this project, careful attention should be paid to dependencies between tasks such as "Review Plan" following "Write Plan" to ensure realistic scheduling. Additionally, identifying parallel paths can help in optimizing resources and reducing project duration. It's important to regularly update the network diagram to reflect actual progress and any changes in task sequencing or dependencies.

3. Document and Comment on the Resource Pool Utilization

The resource pool utilization highlights the assignment of specific roles (e.g., Project Manager, Documentation Engineer) to tasks, ensuring that the necessary skills are available when needed. It also helps in identifying potential over-allocations or underutilizations, enabling proactive adjustments. For instance, the involvement of multiple engineers across various tasks (e.g., Programmers/Software Engineers 378 in multiple phases) suggests a comprehensive engagement strategy. However, it's critical to monitor workload distribution to prevent burnout and ensure equitable task allocation. Leveraging tools for resource leveling can aid in optimizing workload across the project lifecycle.

4. Document the Baseline Estimation Calculations

Baseline Estimation Calculations are pivotal for setting expectations around project costs, duration, and resource needs. They involve estimating the effort, duration, and cost of tasks based on historical data, expert judgment, and other estimation techniques (e.g.,

parametric, analogical). For this project, estimations appear to have been derived systematically for each phase and task, allowing for a structured budgeting and scheduling process. It is essential to include contingency reserves for time and cost to accommodate uncertainties. Regularly comparing actual performance against these baseline estimates is crucial for effective project control and management.

Part2 Calculation

We know that: $\text{Effort} = \text{Amount of work} / \text{Productivity rate}$, $\text{Duration} = \text{Effort} / \text{No. of Resources}$
as D Let's take Given Amount of work as "W",

Project plan: days

1. Write Plan: Amount of work = 182 pages, Productivity rate = 4 pages/Hour
 $W = 182/4 = 46\text{hrs} = 6\text{dys}/1\text{HCT}$
 $D = 6/1 = 6 \text{ days.}$
2. Review Plan:
 - a. Preparation for review: Amount of work = 182 pages, Productivity rate = 4 pages/Hour
 $\text{Effort} = \text{Amount of work} / \text{Productivity rate} = 182/4 = 46\text{hrs} = 6\text{dys}/1\text{HCT}$
 $D = (6\text{days}/1\text{HCT}) * 5 = 6 \text{ days}/5\text{HCT.}$
 - b. Review Meeting: Amount of work = 182 pages, Productivity rate = 8 pages/Hour
 $W = 182/8 = 23\text{hrs} = 3\text{dys}/1\text{HCT}$
 $D = (3\text{days}/1\text{HCT}) * 6 = 3\text{days}/6\text{HCT.}$
3. Rework: Amount of work = 176 defects, Productivity rate = 6 defects/Hour
 $W = 176/3 = 30\text{hrs} = 4\text{dys}/1\text{HCT}$
 $D = 3/1 = 3 \text{ days.}$

Requirement: 29 days

1. Write requirements: Amount of work = 410 Req, Productivity rate = 4 Req/Hour
 $W = 410/4 = \text{Roundoff}(102.5) = 103\text{hrs} = 13\text{dys}/1\text{HCT}$
 $D = 13/3 = 5 \text{ days.}$
2. Review Requirements:
 - a. Preparation for review: Amount of work = 410 Req, Productivity rate = 5 Req/Hour
 $W = 410/5 = 82\text{hrs} = 11\text{dys}/1\text{HCT}$
 $D = (11\text{dys}/1\text{HCT}) * 4 = 11 \text{ days}/4\text{HCT.}$
 - b. Review Meeting: Amount of work = 410 Req, Productivity rate = 8 Req/Hour
 $W = 410/8 = \text{roundoff}(51.25) = 52\text{hrs} = 7\text{dys}/1\text{HCT}$
 $D = (7\text{dys}/1\text{HCT}) * 5 = 7 \text{ days}/5\text{HCT.}$
3. Rework: Amount of work = 378 defects, Productivity rate = 4 defects/Hour
 $W = 378/4 = \text{Roundoff}(94.5) = 95\text{hrs} = 12\text{dys}/1\text{HCT}$
 $D = 12/2 = 6 \text{ days.}$

Lab and Environment Setup: 18 days

1. Hardware:
 - i. Install Network Elements:
 - a. Routers: Amount of work = 10, Productivity rate = 3 Routers/day
 $W = (10/(3/8)) = 27\text{hrs} = 4\text{dys}/1\text{HCT}$
 $D = 4/2 = 2 \text{ days.}$
 - b. Bridge: Amount of work = 30, Productivity rate = 2 Bridges/day
 $W = (30/(2/8)) = 120\text{hrs} = 15\text{dys}/1\text{HCT}$
 $D = 15/3 = 5 \text{ days.}$

- ii. Install Server: Amount of work = 26 servers, Productivity rate = 3 servers/day
 $W = (26/(3/8)) = 70\text{hrs} = 9\text{dys}/1\text{HCT}$
 $D = 9/4 = 3 \text{ days.}$
- iii. Install Clients: Amount of work = 90 clients, Productivity rate = 10 clients/day
 $W = (90/(10/8)) = 72\text{hrs} = 9\text{dys}/1\text{HCT}$
 $D = 9/4 = 3 \text{ days.}$
- 2. Software:
 - i. Install Development Tools: Amount of work = 21 tools, Productivity rate = 5 tools/day
 $W = (21/(5/8)) = 34\text{hrs} = 5\text{dys}/1\text{HCT}$
 $D = 5/2 = 3 \text{ days.}$
 - ii. Install Testing Tools: Amount of work = 21 tools, Productivity rate = 8 tools/day
 $W = (21/(8/8)) = 21\text{hrs} = 3\text{dys}/1\text{HCT}$
 $D = 3/2 = 2 \text{ days.}$
- Analysis/Design Document: 28 days
 - 1. Write DD: Amount of work = 403 pages, Productivity rate = 4 pages/Hour
 $W = 403/4 = 101\text{hrs} = 13\text{dys}/1\text{HCT}$
 $D = 13/3 = 5 \text{ days.}$
 - 2. Review DD:
 - a. Preparation for DD: Amount of work = 403 pages, Productivity rate = 4 pages/Hour.
 $W = 403/4 = 101\text{hrs} = 13\text{dys}/1\text{HCT}$
 $D = (13\text{dys}/1\text{HCT}) * 4 = 13 \text{ days}/4\text{HCT.}$
 - b. Review Meeting: Amount of work = 403 pages, Productivity rate = 8pages /Hour.
 $W = 403/8 = 51\text{hrs} = 7\text{dys}/1\text{HCT}$
 $D = (7\text{dys}/1\text{HCT}) * 5 = 7 \text{ days}/5\text{HCT.}$
 - 3. Rework: Amount of work = 343 defects, Productivity rate = 5 defects/Hour.
 $W = 343/5 = 69\text{hrs} = 9\text{dys}/1\text{HCT}$
 $D = 9/3 = 3 \text{ days.}$

Data Model: 10 days

- 1. Create Data Model(DM): Amount of work = 48 pages, Productivity rate = 1 pages/Hour.
 $W = 48/1 = 48\text{hrs} = 6\text{dys}/1\text{HCT}$
 $D = 6/2 = 3 \text{ days.}$
- 2. Review Data Model:
 - a. Preparation for DM: Amount of work = 48 pages, Productivity rate = 4 pages/Hour
 $W = 48/4 = 12\text{hrs} = 2\text{dys}/1\text{HCT}$
 $D = (2\text{dys}/1\text{HCT}) * 4 = 2 \text{ days}/4\text{HCT.}$
 - b. Review Meeting: Amount of work = 48 pages, Productivity rate = 10 pages/Hour
 $W = 48/10 = \text{roundoff}(4.8) = 5\text{hrs} = 1\text{dys}/1\text{HCT}$
 $D = (1\text{day}/1\text{HCT}) * 5 = 1 \text{ day}/5\text{HCT.}$
- 3. Rework: Amount of work = 309 defects, Productivity rate = 5 defects/Hour
 $W = 309/5 = \text{Roundoff}(61.8) = 62\text{hrs} = 8\text{dys}/1\text{HCT}$
 $D = 8/2 = 4 \text{ days.}$

Coding and unit test: 101 days

- 1. Write Code: Amount of work = 8420 SLOC, Productivity rate = 6 SLOC/Hour
 $W = 8420/6 = 1403\text{hrs} = 176\text{dys}/1\text{HCT}$
 $D = 176/5 = 36 \text{ days.}$
- 2. Unit testing:
 - a. Prepare/Execute Test cases: Amount of work = 945 test cases,
 Productivity rate = 5 testcases/Hour.
 $W = 945/5 = 189\text{hrs} = 24\text{dys}/1\text{HCT}$
 $D = 24/5 = 5 \text{ days.}$

b. Fix Found Defects: Amount of work = 783 defects, Productivity rate = 13 defects/Day.
 $W = (783 / (13/8)) = 482\text{hrs} = 61\text{dys}/1\text{HCT}$

$D = 61/5 = 13 \text{ days.}$

c. Test fixed defects: Amount of work = 783 defects, Productivity rate = 10 defects/Day.
 $W = (783 / (10/8)) = 627\text{hrs} = 79\text{dys}/1\text{HCT}$

$D = 79/5 = 16 \text{ days.}$

3. Code Inspection:

a. Preparation for code inspection: Amount of work = 8420 SLOC,
 Productivity rate = 70 SLOC/Hour

$W = 8420/70 = \text{roundoff}(120.28) = 121\text{hrs} = 16\text{dys}/1\text{HCT}$

$D = (16\text{dys}/1\text{HCT}) * 4 = 16 \text{ days}/4\text{HCT.}$

b. Code Inspection Meeting: Amount of work = 8420 SLOC,
 Productivity rate = 120 SLOC/Hour

$W = 8420/120 = 71\text{hrs} = 9\text{dys}/1\text{HCT}$

$D = (9\text{dys}/1\text{HCT}) * 5 = 9 \text{ days}/5\text{HCT.}$

c. Rework: Amount of work = 935 defects, Productivity rate = 5 defects/Hour

$W = 935/5 = 187\text{hrs} = 24\text{dys}/1\text{HCT}$

$D = 24/4 = 6 \text{ days.}$

Testing: 166 days

1. Write Test Plan(TP): Amount of work = 357 pages, Productivity rate = 8 pages/Day

$W = (357 / (8/8)) = 357\text{hrs} = 45\text{dys}/1\text{HCT}$

$D = 45/4 = 12 \text{ days.}$

2. Review TP:

a. Preparation for TP: Amount of work = 357 pages, Productivity rate = 5 pages/Hours

$W = (357/5) = 72\text{hrs} = 9\text{dys}/1\text{HCT}$

$D = (9\text{dys}/1\text{HCT}) * 4 = 9 \text{ days}/4\text{HCT.}$

b. Review TP Meeting: Amount of work = 357 pages, Productivity rate = 10 pages/Hour

$W = 357/10 = 36\text{hrs} = 5\text{dys}/1\text{HCT}$

$D = (5\text{dys}/1\text{HCT}) * 5 = 5\text{days}/5\text{HCT.}$

c. Rework: Amount of work = 290 defects, Productivity rate = 5 defects/Hour

$W = 290/5 = 58\text{hrs} = 8\text{dys}/1\text{HCT}$

$D = 8/3 = 3 \text{ days.}$

3. Execute TP(test cases): Amount of work = 810 testcases, Productivity rate = 8 test cases/Day

$W = (810 / (8/8)) = 810\text{hrs} = 102\text{dys}/1\text{HCT}$

$D = 102/5 = 21 \text{ days.}$

4. Fix Found Defects: Amount of work = 306 defects, Productivity rate = 5 defects/Day

$W = (306 / (5/8)) = 490\text{hrs} = 62\text{dys}/1\text{HCT}$

$D = 62/4 = 16 \text{ days.}$

Documentation: 31 days

1. User Documentation: Amount of work = 510 pages, Productivity rate = 5 pages/Hour

$W = 510/5 = 102\text{hrs} = 13\text{dys}/1\text{HCT}$

$D = 13/4 = 4 \text{ days.}$

2. Review UD:

a. Preparation for UD review meeting: Amount of work = 510 pages, Productivity rate = 5 pages/Hour

$W = 510/5 = 102\text{hrs} = 13\text{dys}/1\text{HCT}$

$D = (13\text{dys}/1\text{HCT}) * 4 = 13\text{days}/4\text{HCT.}$

b. Review UD Meeting: Amount of work = 510 pages, Productivity rate = 7 pages/Hour

$W = 510/7 = 73\text{hrs} = 10\text{dys}/1\text{HCT}$

$D = (10\text{dys}/1\text{HCT}) * 5 = 10 \text{ days}/5\text{HCT.}$

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c. Rework: Amount of work = 490 defects, Productivity rate = 5 defects/Hour
 $W = 490/5 = 98\text{hrs} = 13\text{dys}/1\text{HCT}$