

Assignment 4 Solutions

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Given Product Size is 120 KLOC

Defect Origin										
Where Found		Requirement	Analysis	Design	Coding	Unit Testing	Integration Testing	System Testing	Field	Total
	Requirement	29								29
	Analysis	19	57							76
	Design	38	51	49						138
	Coding	25	37	38	231					331
	Unit Testing	13	14	41	103	9				180
	Integration Testing	21	22	42	32	-	7			124
	System Testing	9	2	13	24	-	-	8		56
	Field	2	2	3	2	-	-	-	2	11
	Total	156	185	186	392	9	7	8	2	945

1.) Calculate the defect removal rate for every phase?

$$\text{Defects Removal Rate} = \frac{\text{Number of Defects removed in current phase}}{\text{Total number of KLOC}} \text{ defects/KLOC}$$

Phase	Defects Removed	Total KLOC	Defect Removal Rate (defects/KLOC)
Requirement	29	120	0.2416
Analysis	76	120	0.6333
Design	138	120	1.15
Coding	331	120	2.7583
Unit Testing	180	120	1.5
Integration Testing	124	120	1.0333
System Testing	56	120	0.4666
Field	11	120	0.0916

2.) Calculate the defect Injection Rate for every phase

$$\text{Defects Injection Rate} = \frac{\text{Number of defects originated in current phase}}{\text{Total number of KLOC}} \text{ defects/KLOC}$$

Phase	Defects Originated	Total KLOC	Defect Injection Rate (defects/KLOC)
Requirement	156	120	1.3
Analysis	185	120	1.5416
Design	186	120	1.55
Coding	392	120	3.2666
Unit Testing	9	120	0.075
Integration Testing	7	120	0.05833
System Testing	8	120	0.0666
Field	2	120	0.0166

3.) Calculate the defect escape rate for each phase

$$\text{Defects Escape Rate} = \frac{\text{Number of Defects Escaped}}{\text{Total number of KLOC}} \text{ defects/KLOC}$$

Phase	Defects originated	Defects removed	Defects Escaped	Total KLOC	Defect Escape Rate
Requirement	156	29	156-29 = 127	120	1.0583
Analysis	185	76	156+185-29-76= 236	120	1.9666
Design	186	138	156+185+186-29-76-138 = 284	120	2.3666
Coding	392	331	156+185+186+392-29-76-138-331 = 345	120	2.8750
Unit Testing	9	180	156+185+186+392+9-29-76-138-331-180 = 174	120	1.4500
Integration Testing	7	124	156+185+186+392+9+7-29-76-138-331-180-124 = 57	120	0.4750
System Testing	8	56	156+185+186+392+9+7+8-29-76-138-331-180-124-56 = 9	120	0.0750
Field	2	11	156+185+186+392+9+7+8+2-29-76-138-331-180-124-56-11 = 0	120	0.0000

4.) Calculate the overall defect removal effectiveness

Overall Defect Removal Effectiveness formula is:

$$\begin{aligned} & \left(\frac{\text{Total No. of Defects removed in all the phases except Field Phase}}{\text{Total number of Defects removed in all the phases}} \right) * 100 \\ &= \left(\frac{29+76+138+331+180+124+56}{945} \right) * 100 \\ &= \left(1 - \frac{11}{945} \right) * 100 \\ &= \mathbf{98.83\%}. \end{aligned}$$

5.) Which phase is most effective in removing the defects? Explain

Defects removal effectiveness is

$$= \frac{\text{Defects removed in this phase}}{\text{Defects existing on entry + Defect injected during development of this phase}} * 100$$

Phase	Defects removed in this phase	Defects existing on entry + Defects Injected during development of this phase	Defects removal effectiveness (%)
Requirement	29	0 + 156 = 156	18.58%
Analysis	76	(156-29) + 185 = 312	24.358%
Design	138	(312-76) + 186 = 422	32.70%
Coding	331	(422-138) + 392 = 676	48.96%
Unit Testing	180	(676-331) + 9 = 354	50.84%
Integration Testing	124	(354-180) + 7 = 181	68.50%
System Testing	56	(181-124) + 8 = 65	86.15%
Field	11	(64-56) + 2 = 10	110.00%

The phase with maximum defect removal effectiveness rate is most effective phase in defect removal. The most effective phase in defect removal with is **system testing** with defect removal percentage ranging up to **86.15%**

For testing phases we use the below formula:

We use Dunn's formula to calculate defect removal effectiveness

$$= \frac{\text{Defects removed in this phase}}{\text{Defects removed in this phase} + \text{Defect removed in subsequent phases}} * 100$$

Phase	Defects Removed in this phase	Defects removed in this Phase + subsequent phases	Dunn's Defect removal effectiveness (%)
Unit Testing	180	180 + (124 + 56 + 11) = 371	48.51%
Integration Testing	124	124 + (56 + 11) = 191	64.92%
System Testing	56	56 + (11) = 67	83.58%

From results of Dunn's Formula, most effective phase in Defects removal is **System Testing**. Defect removal effectiveness of system Testing is **83.58%**

6.) Do you think reviews and inspections were effective? Explain.

Overall Defect removal effectiveness = **98.83%**

Overall Inspection Efficiency = (defects removed in inspection / total defects) * 100
= ((29 + 76 + 138 + 331) / 945) * 100
= **60.74%**

Considering all the calculations we can say that reviews and inspection at coding were more effective as a greater number of defects were identified. As overall results matter more than the individual phase results we can state that reviews and inspection were effective in removing defects. Also, the above calculations clearly state that defect removal effectiveness is greater than CMM level 5 which makes its maturity level an excellent quality.

Hence, we can say that **Reviews and Inspections were effective**.