**Assignment 5 – Part 1**

1. **Calculate the defect removal rate for every phase.**

Defect removal rate = number of defects removed / 120KLOC

|  |  |  |
| --- | --- | --- |
| **Phase** | **Number of Defects removed** | **Defect Removal rate** |
| Requirement | 223 | 1.858 |
| Analysis | 136 | 1.133 |
| Design | 311 | 2.591 |
| Coding | 508 | 4.233 |
| Unit testing | 244 | 2.033 |
| Integration Testing | 111 | 0.925 |
| System Testing | 67 | 0.558 |
| Field | 18 | 0.15 |

1. **Calculate the defect injection rate for every phase**.

Defect injection rate = number of defects injected / 120 KLOC

|  |  |  |
| --- | --- | --- |
| Phase | Number of Injected Defects | Defect Injectional rate |
| Requirement | 542 | 4.52 |
| Analysis | 207 | 1.73 |
| Design | 373 | 3.11 |
| Coding | 472 | 3.94 |
| Unit testing | 4 | 0.04 |
| Integration Testing | 7 | 0.06 |
| System Testing | 6 | 0.05 |
| Field | 7 | 0.06 |

1. **Calculate the defect escape rate for every phase.**

Defect escape rate = Number of defects escaped / 120 KLOC

Number of defects escaped = Number of defects injected + Number of defects

escaped from prior phase – Number of defects removed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Phase | Total Number of Defects Injected (A) | Total Number of Defects Escaped from prior phase (B) | Total number of defects removed (C) | Total number of defects escaped.  (A+B-C) | Defect escape rate |
| Requirement | 542 | 0 | 223 | 319 | 2.658 |
| Analysis | 207 | 319 | 136 | 390 | 3.25 |
| Design | 373 | 390 | 311 | 452 | 3.766 |
| Coding | 472 | 452 | 508 | 416 | 3.466 |
| Unit testing | 4 | 416 | 244 | 176 | 1.466 |
| Integration Testing | 7 | 176 | 111 | 72 | 0.6 |
| System Testing | 6 | 72 | 67 | 11 | 0.091 |
| Field | 7 | 11 | 18 | 0 | 0 |

1. **Calculate the overall defect removal effectiveness.**

Overall defect removal effectiveness = [(1 – (Defects in field / Total defects)] \* 100

Overall defect removal effectiveness = (1 – 18/1618) \* 100 = 98.88%

1. **Which phase is the most effective in removing defects? Explain.**

Defect removal effectiveness = No. of defects found / no. of defects injected from previous Phase + No. of defects injected.

Phase wise defect removal effectiveness

Requirement = [223 / 542] \*100 = 41.143%

Analysis = [136 / (207+319)] \*100 = 25.855%

Design = [311 / (373+390)] \*100 = 40.76%

Coding = [508 / (472+452)] \*100= 54.978%

Unit testing = [244 / (4+416)] \*100= 58.095%

Integration testing = [111 / (7+176)] \*100 = 60.655%

System testing = [67 / (6+72)] \*100 = 85.897%

Field = [18 / (7+11)] \*100 = 100%

As we can see in the calculation, the most effective phase is system testing with defect removal rate 85.897%.

For testing phase, we use below formula.

= (Defect removal at current phase / (Defect removal at current phase + Defect removal at subsequent phase)) defects / KLOC

|  |  |  |  |
| --- | --- | --- | --- |
| Phase | Defects removes in this Phase | Defects removes in this Phase + subsequent Phase | Dunn’s Defect removal effectiveness (%) |
| Unit Testing | 244 | 244+(111+67+18) = 440 | 55.454% |
| Integration testing | 111 | 111+(67+18) = 196 | 56.632% |
| System testing | 67 | 67+(18) = 85 | 78.823% |

Based on the above table, the most effective phase in defect removal is system testing and effectiveness of that phase is 78.823%.

1. **Do you think review and inspections were effective? Explain**

Overall defect removal effectiveness is 98.887%.

Overall Inspection efficiency = (defects removed in Inspection / Total defects) \* 100

= ((223+136+311+508)/1618) \*100

= 72.805%

As a greater number of defects were identified in coding phase, even by considering all the phases, we can say that review and inspection are very effective for the defect removal.

We can also interpret that overall defect removal effectiveness is greater than CMMI 5 criteria.

1. **If the number of defects originated in design phase increased by 15% and defects detected in design review increased by 60% would this change increase or decrease the defects escaped to the coding phase? Explain your answer in detail (present data to support your answer).**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Phases | Requirement | Analysis | Design | Coding | Unit Testing | Integration Testing | System Testing | Field | Total |
| Requirement | 223 |  |  |  |  |  |  |  | 223 |
| Analysis | 102 | 34 |  |  |  |  |  |  | 136 |
| Design | 89.60 | 72 | 336 |  |  |  |  |  | 497.6 |
| Coding | 97 | 71 | 71.3 | 278 |  |  |  |  | 517.3 |
| Unit Testing | 43 | 31 | 49.45 | 123 | 4 |  |  |  | 250.45 |
| Integration Testing | 12 | 21 | 39.1 | 37 |  | 7 |  |  | 116.1 |
| System Testing | 7 | 4 | 24.15 | 29 |  |  | 6 |  | 70.15 |
| Field | 2 | 1 | 3.35 | 5 |  |  |  | 7 | 18.35 |
| Total | 575.6 | 234 | 523.35 | 472 | 4 | 7 | 6 | 7 |  |

Defect Escape rate = Defects escaped / Product size in KLOC

Product Size:120 KLOC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | Defects Detected | Defect Injected | Defects escaped | Defect escape rate |
| Requirement | 223 | 575.6 | 575.6 – 223 = 352.6 | 2.93 defects/KLOC |
| Analysis | 136 | 234 | 575.6 + 234 – 223 – 136 = 450.6 | 3.75 defects/KLOC |
| Design | 497.6 | 523.35 | 575.6 + 234 + 523.35 + 472 – 223 – 136 – 497.6 – 517.3 = 431.05 | 3.96 defects/KLOC |
| Coding | 517.3 | 472 |  | 3.59 defects/KLOC |

* For coding phase, considering default values, we get the defect escape rate 3.4666.
* After increasing defects origin at design phase by 15% and defects detected in design review by 60%, we get the defect escape rate is 3.59.
* So, there is an increase in number of defects escaped to the coding phase.