Report Based On 50 Products

Of A Manufacturing Company

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1. Introduction

The quality control manager investigated 50 numbers of recently products from three aspects and divided them with different scores. Theoretically, these samples can reflect some general characteristics of the recent products. First of all, conduct a single inspection of the qualified situation, then use three inspection dimensions to grade the sampling inspection products, use these results to do some mathematical calculation, and reflect some problems of the products.

1. Analysis

Part 1

|  |  |  |  |
| --- | --- | --- | --- |
| Event of Interest: | Notation for the Probability of the given event: | Count: | Probability  /Percentage |
| Event Q:  Quality Score > 500 | P(Q ) | 29 | 58% |
| Event S:  Speed < 13 days | P(S ) | 22 | 44% |
| Event C:  Cost < 234,000 | P(C ) | 26 | 52% |

The table reflects the number and percentage of the total samples in each evaluation. The most qualified is the quality index(58%), but still less than 60%.The lowest number of meeting the target is the duration index, with only 44% of the samples having a duration less than 13 days. In terms of cost, 52% of the products in the sample could be controlled within $23,400.

|  |  |
| --- | --- |
| Descriptive statistics | Quality Score |
| mean | 529.62 |
| StError | 36.6922212 |
| medium | 529 |
| mode | 531 |
| StDeviation | 259.453184 |
| Sample Variance | 67315.9547 |
| Kurtosis | -1.0904063 |
| Skewness | 0.08356159 |
| Range | 925 |
| Minimun | 68 |
| Maximun | 993 |
| Sum | 26481 |
| Count | 50 |

Descriptive statistics are analyzed by Excel. The standard deviation of Quality Score is relatively small, and the average value is close to the median value, both are above the standard line of Quality Score, so the distribution is relatively symmetric around the average value. However, the standard deviation, sample variance and range are all large, meaning that the quality of samples is unevenly distributed. Some of them are of good quality and some of them are of poor quality.

Part 2

|  |  |  |  |
| --- | --- | --- | --- |
|  | Notation for the Probability of the given event: | Count: | Probability  /Percentage |
| P(Score = 0) | P(Q'∩S'∩C') | 6 | 12% |
| P(Score = 1) | P(Q∩S'∩C') | 9 | 18% |
| P(Score = 2) | P(Q'∩S∩C') | 5 | 10% |
| P(Score = 3) | P(Q'∩S'∩C) | 4 | 8% |
| P(Score = 4) | P(Q∩S∩C') | 4 | 8% |
| P(Score = 5) | P(Q∩S'∩C) | 9 | 18% |
| P(Score = 6) | P(Q'∩S∩C) | 6 | 12% |
| P(Score = 7) | P(Q∩S∩C) | 7 | 14% |
|  | TOTAL: | 50 | 100% |

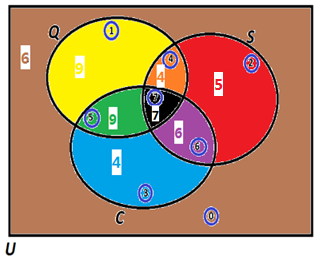
According to the results in table 1, the 50 samples were classified into 8 different situations based on three indicators, and a score of 0 to 7 was given. This is a further partition for the sample performance, which shows quantity and proportion of samples that can satisfied two and three indicators. R calculation shows that the probability of satisfying three different indicators are not independent.

Only seven products (14%) in the sample meet all the three indicators. Samples that are only-Q substandard consist of 12%. Only-S substandard samples are 18%, and only-C substandard samples are 8%, which is same to the proportion of only-C standard samples. Sample size of only-Q standard and only-S standard are the biggest (18% for each one), while samples of only-C standard and only-C substandard consist of the least part of fifty samples (8% for each one).Six of the fifty samples meets none of the three standards(16%).

In terms of scoring, the sample presents more data in low segment (0-2) and high segment (5-7), and the middle segment (3-4) has less data. Explain that the difference in Quality Score, Process Days, and Project Cost are relatively large.

Part 3

The Venn diagram below describes the sample space and the three events. The values inside circles in each of the eight regions of the Venn diagram indicates the score corresponding to that region. The numbers in different colors show the count of each region in same color.



Part 4

|  |  |  |  |
| --- | --- | --- | --- |
|  | Notation for the Probability of the given event: | Probability  /Percentage | Count |
| 1. Of those who satisfied cost, what percentage also satisfied Speed? | P(S|C) | 50% | 13 |
| 1. Of those who satisfied Quality, what percentage also satisfied Cost? | P(C|Q) | 72% | 16 |
| 1. Of those who satisfied Quality, what percentage also satisfied Speed but did not satisfy the Cost? | P(S∩C'|Q) | 18% | 4 |
| 1. Of those who satisfied Cost, what percentage also satisfied Speed but did not satisfy the Quality? | P(S∩Q'|C) | 23% | 6 |
| 1. Of those who did not satisfy Speed, what percentage satisfied Quality and Speed? | P(C∩Q|S’) | 43% | 9 |
| 1. What percentage satisfied exactly two of the three criteria? | P(C∩S∩Q')+ P(C∩S'∩Q)+  P(C'∩S∩Q) | 38% | 19 |
| 1. Of those who satisfied at least one of the three criteria, what percentage satisfied exactly one criterion? | [P(Q'∩S'∩C)+P(Q∩S'∩C')+  P(Q'∩S∩C')]  /[1-P(Q'∩S'∩C')] | 24% | 11 |
| 1. Of those who did not satisfy Cost, what percentage satisfied the Speed criterion? | P(S|C’) | 38% | 9 |

R calculation shows that the probability of satisfying three different indicators are not independent. So the mathematical calculation will focus on the total number with the help of Venn, and then calculate the probability.

1. P(S|C)=P(S∩C)/P(C )

P(S∩C)=13/50

P(C )=26/50

1. P(C|Q)=P(Q∩C)/P(Q )

P(Q∩C)=16

P(Q)=29/50

1. P(S∩C'|Q)=P(Q∩S∩C')/P(Q )

P(Q∩S∩C')=4/50;P(Q)=29/50

1. P(S∩Q'|C)=P(C∩S∩Q')/P(C )

P(C∩S∩Q')=6/50

P(C )=26/50

1. P(C∩Q|S’)=P(C∩Q∩S' )/P(S' )

P(C∩Q∩S' )=9/50

P(S')=1-P(S)=1-22/50

1. P(C∩S∩Q')+ P(C∩S'∩Q)+ P(C'∩S∩Q)=6/50+9/50+4/50
2. [P(Q'∩S'∩C)+P(Q∩S'∩C')+P(Q'∩S∩C')]/[1-P(Q'∩S'∩C')]

=(4/50+9/50+2/50)/(1-6/50)

1. P(S|C’)=P(S∩C')/P(C')

P(S∩C')=6/50

P(C')=1-P(C )=1-26/50

1. Conclusion

The probability of sample products reaching the scoring standard is too low, among which the ones reaching the Quality standard are the most and the ones reaching the Speed standard are the least. The sample distribution was scattered when the three indicators were examined at the same time. Only 14% of the samples met the requirements. 12% of the products did not satisfied any of the indicators and 36% of the products passed only one, which accounted for 48% of the total sample, indicating that the product as a whole did not meet the standards.

According to all the findings and analysis, the following improvement ideas are proposed:

1. The company should pay attention to this problem and select more samples for data analysis to improve the representativeness of the analysis results for the company's products, since fifty samples may not be enough to tell the truth about all the products. The correlation between the three variables is shown by R. If the correlation coefficient can be found, the correlation degree of the three indicators can be important clue to find out the main problems existing in the products.
2. For samples in less than two standard samples, identify the person responsible for those products. Ask them if they were aware of the situation and check their work performance, especially the operation management of the production workshops.
3. Quality is the most qualified, followed by Process Days(satisfied as S) and Process Days(satisfied as C). Therefore, if the manufacturing company wants to improve the compliance rate of products, Process Days and Process Days should be the focus of improvement. Specifically, samples with slow production speed are generally from the same production line or factory. If the company is operating an outsourced production project, the company should consider urging the improvement of the production line or changing the cooperative factory. If the company runs a self-produced and self-selling business model, first check the accounting method of product cost, determine which stage the high cost comes from: production, sales, operation, etc. According to the specific stage, personnel allocation, budget, size and other aspects can be inspected to improve. Production lines and operating models that are too costly should be considered outsourcing to more specialized cooperators.
4. Quality Score has a large distribution in the sample products, which indicates that the quality of the products is uneven. Meanwhile, it means the company could have done better. The company should check the production lines with low samples of Quality Score. Find out whether the quality is not up to standard due to personnel operation or technical problems. Identifying the root cause of the problem can always lead to better improvement.