



# QVscribe

## Common Requirement

## Problem Words:

***AND***



# Introduction

**Let’s consider a common situation.** You are writing requirements for a project. You run QVscribe to check the quality of these requirements. You quickly work through numerous flagged problem words, but then you come across one that perplexes you.

Maybe you think:

- My requirement makes sense
- I don’t understand why this word is a problem, or
- I have no idea how to fix the issue

**You are not the outlier.**

Writing clear, unambiguous, and verifiable requirements can be a daunting task. How requirements should be written differs from natural speech patterns, where we naturally focus on ensuring our information flows nicely, sounds good, and covers all details. Often, requirements do not need flowery words. In contrast to how we naturally speak and write, requirements must be formal, textual, and singular statements. They convey what shall be done and by what entity.

The issue here is usually not a lack of understanding around the purpose and importance of requirements, but the struggle with implementing what we know into our authoring. Realistically, we may need a little more support or guidance to re-word and re-write our requirements. Sometimes, certain words may seem impossible to re-word or resolve, or we use certain words so frequently that we do not know another way to write what we mean.

Based on your feedback and our research, we found many common problem words seen across industries within requirements.

In the following series, we will go through common problem words. I will explain why the word is a problem and how to resolve it. I will also demonstrate some examples and exceptions to better understand the issue.

This article will focus on the word *And*.

# Table of Contents

**Why is *And* a problem word?** ..... 4

    QVscribe Quality Analysis ..... 4

    INCOSE Guide for Writing Requirements ..... 5

    Characteristic 5 - C5 - Singular ..... 6

    Rule 11 - R11 - /Concision/SeparateClauses ..... 6

    Rule 18 - R18 - /Singularity/SingleSentence ..... 6

    Rule 19 - R19 - /Singularity/AvoidCombinators ..... 6

    English Writing Best Practices and Grammar Rules ..... 7

**How do we fix *And*?** ..... 8

    QVscribe Quality Analysis ..... 8

    INCOSE Guide for Writing Requirements ..... 9

    Guidance on Excessive Continuances ..... 9

    Guidance for the Word *And* ..... 9

    Possible Exceptions ..... 9

    English Writing Best Practices and Grammar Rules ..... 10

**Examples using *And*** ..... 11

    Example 1 ..... 11

    Example 2 ..... 12

    Example 3 ..... 14

**Next time** ..... 15

**References** ..... 15

# Why is *And* a problem word?

*And* is the third most common word in the English language. It is also a common word that QVscribe flags as a problem.

Let's look at why *And* can be a problem based on the QVscribe Quality Analysis, the International Council on Systems Engineering (INCOSE) Guide for Writing Requirements, and English Writing Best Practices and Grammar Rules.

## QVscribe Quality Analysis

QVscribe analyzes requirements for quality, consistency, and similarity. In the QVscribe Quality Analysis, the software will flag problem words and phrases based on requirement best practices and INCOSE standards. Each word is categorized into a Problem Type that has a level of severity based on the category and frequency of occurrence.

In the QVscribe Quality Analysis, the word *And* is flagged as an Excessive Continuation. Excessive Continuances are often an indicator that multiple thoughts are tied together - thoughts that are allocated and verified differently.

Requirements that use excessive continuances are usually not singular statements, and processes within a project depend on identifying singular statements, such as traceability, verification, and validation. *And* is likely an indicator of a compound requirement that describes more than one outcome.

Excessive Continuances tend to be considered low-risk. However, the likelihood of poor and high-risk requirements is considerable depending on the repetition and placement of an excessive continuation, such as *And*.

**Note:** To be flagged for an excessive continuation, the word *And* needs to come up at least three times in the same requirement. The use of three or more continuances in the same requirement is a strong signal the requirement needs to be split into two or more singular statements.

## INCOSE Guide for Writing Requirements

QVscribe uses requirement best practices and the INCOSE Guide for Writing Requirements to flag potential problems and score each requirement. The INCOSE Guide for Writing Requirements focuses on the authoring of requirements and specific characteristics and rules that should be followed to align with their standard.

Based on the INCOSE Guide for Writing Requirements why is the word *And* a problem?

The word *And* and using excessive continuances do not align with the following characteristics and rules within the INCOSE Guide for Writing Requirements.

- Characteristic 5 - C5 -Singular
- Rule 11 - R11 - /Concision/SeparateClauses
- Rule 18 - R18 - /Singularity/SingleSentence
- Rule 19 - R19 - /Singularity/AvoidCombinators

Let's briefly examine how these rules and characteristics detail the use of the word *And*. For a detailed breakdown please refer to the INCOSE Guide for Writing Requirements.

### Characteristic 5 - C5 - Singular

One of the main characteristics of a requirement statement is that it's singular. That means the requirement has a single capability, characteristic, constraint, or quality factor.

The translation from a need to a requirement can result in a one-to-one, many-to-one, or one-to-many transformation. Ultimately, the requirement statement must represent a single thought.

Excessive continuances are specifically outlined in Characteristic 5 - Singular (C5) but also impact other characteristics. If a requirement is not singular it cannot be Verifiable (C7), Correct (C8), Unambiguous (C3), nor Complete (C84).

The rules help to enforce the characteristics and provide structure for writing requirements.

**Note:** Other rules may be violated depending on the context of the requirement.



Excessive Continuances violate the following rules:

**Rule 11 - R11 - /Concision/SeparateClauses**

Rule 11 states that you must use a separate clause for each condition or qualification. Each requirement should have a main verb describing a basic function or need, and when appropriate conditions or qualifications included in the requirement.

**Rule 18 - R18 - /Singularity/SingleSentence**

Rule 18 states a requirement must be a single sentence that contains a single thought conditioned and qualified by relevant sub-clauses. Compound sentences contain more than one subject/verb/object and should be avoided.

To accurately trace the source and potential child and parent linkages requirements must contain a single thought.

If there are multiple actions for a single condition, it's recommended that each action is its own requirement, rather than stating the conditions and then listing the multiple actions. This measure supports analysis and ensures that the system is verified to perform each action and that each action can be properly allocated and validated.

The process also makes it easier to reuse the requirements because there may be a future project where only one of the parts will apply. If it's split up into singular statements, the relevant ones can be selected for reuse, and the irrelevant ones can easily be left out.

**Rule 19 - R19 - /Singularity/AvoidCombinators**

Rule 19 states that you must avoid combinators. Combinators are words that join together separate clauses. The presence of combinators usually indicates the need to separate the requirement into multiple singular and stand-alone requirements.

Some examples of combinators include:

- Or
- The
- And
- Unless
- But
- As well as
- But also
- However
- Whether
- Meanwhile
- Whereas
- On the other hand
- Otherwise

**English Writing Best Practices and Grammar Rules**

The word *And* can also be an issue when writing in English. Particularly the excessive use of *And*, this is a run-on sentence.

The word *And* is often the culprit when writing run-on sentences. Using *And* too often can make a sentence hard to follow. The use of run-on sentences often occurs with junior authors, as they are attempting to provide as much detail as possible.



# How do we fix *And*?

Now that we know why the word *And* can be a problem based on the QVscribe Quality Analysis, the INCOSE Guide for Writing Requirements, and English Writing Best Practices and Grammar Rules, how do we fix it?

## QVscribe Quality Analysis

The recommendations provided by QVscribe are straightforward. We recommend working towards a unitary requirement by removing excessive continuances - to split compound requirements into separate singular requirements.

While completing these changes consider the following questions:

- How easy is it to understand this requirement?
- If describing multiple outcomes, what happens if one is missed?
- How do you track and trace each outcome when combined into one statement?

### Possible Exceptions

If separating the requirement and removing any or all of the continuances makes the requirement less clear you may choose to leave them. It is possible to write a compound requirement using only one continuance, but ensure these phrases are only used when absolutely necessary.

## INCOSE Guide for Writing Requirements

The INCOSE Guide for Writing Requirements focuses heavily on ensuring you are authoring singular requirements. Rather than fixing the problem, much of their guidance and recommendations are more about preventing excessive continuances and other issues that using the word *And* may contribute.

### Guidance on Excessive Continuances

Your requirement must be limited to one quality, characteristic, capability, function, or constraint. It's also vital to fully understand how the statements fit into the allocation and traceability of the project.

Often when there are multiple sentences for one requirement, the second sentence is attempting to communicate the conditions for use or the rationale for the requirement. This method is not acceptable for requirement writing. Exclude accompanying information like rationales, notes, comments, motivation, or explanations. It is best practice to contain this information in its own labeled section below the requirement or as a separate attribute.

For more information about rationale best practices, please refer to the INCOSE Needs and Requirements Manual, Section 15, A1.

### Guidance for the word *And*

Please avoid using the word *And*, specifically when it links multiple thoughts or phrases into one sentence. Each thought may be allocated or verified differently, and linking them together can create issues.

Beware of the word *And* in a requirement, it should always prompt the reader or author to consider whether the requirement is singular.

### Possible Exceptions

In certain situations and within organizations, two actions must execute together, meaning you would never do one action without the other. In this case, using *And* to join two actions is acceptable. These two actions will always be allocated, traced, and verified together, therefore, communicated within a single requirement.



## English Writing Best Practices and Grammar Rules

Run-on sentences are grammatically incorrect. I will outline some general guidelines and recommendations to correct this issue.

- 1. Separate Each Clause:** If the clauses are independent, they should be separated. Add end punctuation to each clause and make them into separate sentences.
- 2. Use a Conjunction or Comma:** Using a comma or conjunction such as *And*, *But*, or *Or* can be appropriate and necessary to join clauses. The use of *And* emphasizes the relationship between the clauses. Note: A conjunction must be used only once in a sentence.
- 3. Use a Semicolon:** If there is a close relationship between two independent clauses, it is grammatically correct to insert a semicolon between the two sentences. Do not use semicolons as a substitute for periods. Only use them if two clauses are connected and of equal importance.

Here are two exceptions when it comes to using the word *And*.

1. *And* can be used once in sentences to connect big ideas.
2. *And* can be used twice in a sentence when making a list of things.

## Examples using *And*

All the theories, guidelines, and rules in the world can be less effective than real examples when resolving an issue.

Let's work through some examples that use *And* to discover alternative solutions and maybe some possible exceptions.

For these examples, we are using the context of a Garage Door Opener.

### Example 1

#### Before:

*The Garage Door opener shall detect an obstruction at distances between 2cm and 1m and within a 150° horizontal range or a 60° vertical range.*

#### Corrected: Split requirements where relevant

*The Garage Door opener shall detect an obstruction at distances between 2cm and 1m.  
The Garage Door opener shall detect an obstruction at a 150 horizontal sensing angle.  
The Garage Door opener shall detect an obstruction at a 60 vertical sensing angle.*

#### Explanation:

This example demonstrates when *And* is used appropriately and inappropriately. The requirement as a whole is non-singular. This type of requirement can be difficult to understand, verify, and allocate.

The requirement is attempting to link three actions:

1. Detecting an obstruction with a distance range
2. Detecting an obstruction from a horizontal sensing angle
3. Detecting an obstruction from a vertical sensing angle

Therefore each action should be its own requirement.

The *And* between 2cm and 1m is appropriate because it's demonstrating a range of length that the Garage Door Opener must be able to detect the obstruction.



## Example 2

### Before 1:

*When the button is pressed and the Garage door is closed, then the Garage Door Opener shall open the Garage Door and when the button is pressed and the Garage door is open, then the Garage Opener shall close the Garage Door.*

### Before 2:

*When the button is pressed, the Garage Door shall close if it is open and shall open if it is closed.*

### Corrected: Split into two requirements

*While the Garage door is closed, when the button is pressed, the Garage Door Opener shall open the Garage Door.*

*While the Garage Door is open, when the button is pressed, the Garage Door Opener shall close the Garage Door.*

### Explanation:

Each action should be in its own requirement to ensure each response from the Garage Door can be verified and allocated properly.

- The action of closing the door should be its own requirement.
- The action of opening the door should be its own requirement.

Often, we author in this way to cover all the details and to be as efficient as possible, but this is where problems can arise.

Before 1: demonstrates the excessive use of the continuances, *And*. It also runs into the issue of multiple imperatives, which automatically gives the requirement a 1 out of 5, making the requirement high-risk. This issue is common when using excessive continuances, as it often indicates that multiple requirements are linked.

Before 2: is not flagged for excessive continuances, as QVscribe is looking for excessive use of continuances (three or more). Although it is not flagged, the use of *And* is inappropriate in this case because it's connecting two separate actions that should be their own requirement. As mentioned, it is common to see the improper use of the word *And* and the use of multiple imperatives. So keep an eye out for this.

**Note:** *is pressed* will be labeled as a potential passive voice and is considered an exception. If a system needs to perform an action when a button is pressed, using passive voice can make it clear that it doesn't matter who or what caused the button to be pressed. QVscribe uses Natural Language Processing (NLP) to detect all instances of passive voice within a requirement. For this reason, when a passive voice check is enabled, alerts are categorized as a Quality Warning and do not impact the Quality Score.



### Example 3

**Before:**

*Where the Keypad is installed, the Garage Door Opener shall require a passcode between 4 characters and 8 characters to open the Garage Door.*

**Corrected: No fix needed.**

*Where the Keypad is installed, the Garage Door Opener shall require a passcode between 4 characters and 8 characters to open the Garage Door.*

**Explanation:**

There is no issue with this use of the word *And*. QVscribe will only flag excessive use of the word *And*, meaning two or more. In this case, the word *And* is used to give a range and is acceptable.

**Note:** *is installed* will be labeled as a potential passive voice and is considered an exception. If a system needs to perform an action when a keypad is installed, using passive voice can make it clear that it doesn't matter who or what installed the keypad. QVscribe uses Natural Language Processing (NLP) to detect all instances of passive voice within a requirement. For this reason, when a passive voice check is enabled, alerts are categorized as a Quality Warning and do not impact the Quality Score.

## Next Time

In the next part of our series, we will go through the common problem word: *Normal*.

## References

- INCOSE Requirements Working Group, Guide for Writing Requirements (Version 3.1), INCOSE, May 2022.
- INCOSE Requirements Working Group, Needs and Requirements Manual (Version 1.1), INCOSE, May 2022.





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