**Experiments 4**: we provide instructions to generate the safety case, and we provide domain knowledge, and we specify GSN syntax (GSN structural rules are specified, and an example of GSN syntax is provided).

**Prompt:**

You are a professional safety case developer assistant.

I will give you the following information in the form of Questions and Answers:

Question 1: What is a safety case?

Answer: A safety case is a structured argument, supported by evidence, intended to justify that a system is acceptably safe.

Question 2: What is the format of the safety case

Answer: I want you to generate a safety case in GSN Format

Question 3: What is the system for which you need to generate a safety case

Answer: X-ray backscattering machine

Question 4: What is the main objective of the safety case

Answer: Create a safety case which seeks to show that radiation over the standard amount (overradiation) will not occur with an x-ray backscattering machine, like what one might see at an airport.

Question 5: What is the evidence available for the X-ray machine

Answer: Formal verification results and Testing results are available for the software operation and Fault tree analysis and Testing results are available for the Timer interlock operation.

I will explain what the components of the safety case in GSN so you can generate it efficiently.

1. Goal – Denoted by G. Documents the claims made in the argument. Goals should contain only claims. For the top-level claim, the author should consider what is the most fundamental objective relevant in the context.

2. Strategy – Denote by S. Describe the reasoning that connects the parent goals and their supporting goals. They should only summarize the argument approach. To focus attention on the function of strategy elements, it is useful for the author to introduce a summary of the argument approach with a phrase such as “Argument by appeal to…”, “Argument by …”, “Argument across …”

3. Solution – Denoted by Sn. Make no claims but are simply references to evidence that provides support to a claim. Solution should refer only to evidence.

4. Context – Denoted by C. There can be two types of contexts, one is a reference to an artifact of some kind. Another is where it draws attention to explanatory contextual information.

5. Assumption – Denoted by A. Declares an assumption made in stating the claim. it is an unsubstantiated sentence. They are connected to the entirety of the argument.

6. Justification – Denoted by J. Does not alter the meaning of the claim made in the goal but provide rationale for its inclusion. They are local to the element to which they are linked.

Some additional contexts on the elements:

To simplify the logic of the argument, it is important to state claims atomically, that is to ensure that each goal element contains only one claim. Goal, context, and solution should be stated atomically. A single node should contain exactly one claim or reference. The use of more than one verb phrase in a goal statement often indicates that the goal contains multiple claims which is not correct. It is important that the text in GSN elements reflects the logical function for which the element was designed. Care should be taken to ensure that the strategies do not restate or redefine the argument process when it is clear from the goal structure. In such cases, the strategies can be omitted. When the relationship between goals and different levels are not clear, then a strategy can be inserted. Where the argument requires that a claim be made about the nature of the support a solution provides for a goal, this should not be stated as part of the solution. Rather, the claim should be stated as a goal to which the evidence item provides a direct solution.

In general, the textual element of arguments should be kept as brief as possible, though the statements made in strategies, justifications, assumptions, and textual definitions should be expressed using as much detail as is necessary for the reader to understand the nature and structure of the argument. Care should be taken to avoid ambiguity and not to overload the terminology. Goals should only contain claims, solutions should only refer to evidence, and strategies should only summarise the argument approach. The statements made in goal elements capture the claims made in the argument. They should be expressed in the form noun-phrase verb-phrase. The noun-phrase identifies the subject of the claim – i.e., the thing with which the statement is concerned. The verb-phrase defines a predicate – it serves to make some assertion about the subject. Care should also be taken to avoid the danger of overstatement when using expressions including ‘all’, ‘any’, ‘each’, ‘every’, ‘typical’ and similar words.

I will provide a table that shows the structural and semantic rules that should be followed while creating the elements:

|  |  |  |
| --- | --- | --- |
| **Element** | **Structural rules** | **Semantic Rules** |
| Structured prose | Directed acyclic graph |  |
| Goal | Allowed connections: Goal to goal, Goal to strategy, Goal to solution, Goal to context, Goal to assumption, Goal to justification | Noun phrase + verb phrase |
| Context | Allowed connections: Context to goal, Context to strategy | Type i: Noun phrase; Type ii: Noun-phrase + verb Phrase |
| Strategy | Allowed connections: Strategy to goal, Strategy to context, Strategy to assumption, Strategy to justification | Strategy statements contain a brief description of the argument approach. |
| Solution | Allowed connections: Goal to solution | Noun-phrase |
| Justification | Allowed connections: Justification to goal, Justification to strategy | Stated fully as necessary complete sentence. Should be a Noun phrase + verb phrase |
| Assumption | Allowed connections: Assumption to goal, Assumption to strategy | Stated fully as necessary complete sentence. Should be a Noun phrase + verb phrase |

Example safety case in GSN format:

G1: Map system is acceptably safe to operate

C1: Map systems is defined

C2: Map role and context

G2: All identified hazards have been eliminated or sufficiently mitigated

C3: Hazards identified from DAO

S1: Argumentation over identified hazard

A1: All hazards have been identified

G3: Hazard H1 has been eliminated

Sn1: Safety rules execution

Create a safety case for the X-ray backscattering machine in GSN format.