Markdown Themes
in Practice

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Introduction   _Markdown_ Themes in Practice

(La)TeX is moderately easy to write, but difficult to read and think about:

> It is strangely difficult to get people to see the point, but the defects of LaTeX for concentration, writing and thought, are at least as great as those of Word, for the simple reason that it gives the writer too much power; there is always another package to call in the preamble, as there is always another drop down menu in Word. [...]

> In markdown – not to put too fine a point on it – the writer is only ever faced with one question, and it is the right one: what the next sentence should be.

[@thompson2010]

Markdown is a lightweight markup language that is easy to both read and write:

```
# First Level Header
## Second Level Header
Now is the time for _all_ good men
to come to the aid of their country.
```

Introduction   Markdown _*Themes*_ in Practice

Markdown package allows TeXperts to style Markdown elements with TeX macros:

```
\def\markdownRendererEmphasis{\emph}
\markinline{Hello _world_} → Hello \markdownRendererEmphasis{world}
                           → Hello \emph{world}
                           → Hello world
```

[Themes][1] allow TeXperts to express large stylesheets as program modules.

[1]: https://doi.org/10.47397/tb/42-2/tb131novotny-markdown
     (V. Novotný. Markdown 2.10.0: LaTeX themes & snippets, two flavors of comments, and LuaMetaTeX. TUGboat 42(2):186−193, 2021.)

Introduction   Markdown Themes _*in Practice*_

In my previous work, I spoke about themes in abstract using simple examples.
Since July 2023, I have been developing complex themes for ISTQB.
This talk is a case study of the ISTQB themes.

After the talk, you will:
1. Understand the purpose of Markdown themes.
2. Know how to create themes for LaTeX.
3. Want a wolf plushie.

Contents

Project Overview

In [my project][2], I developed a LaTeX document class and six Markdown themes. Document class is called `istqb` and it implements design and LaTeX markup. Themes are called `istqb/*`, they are written in the expl3 programming language, and they process YAML and Markdown documents, see next slide.

[2]: https://github.com/istqborg/istqb_product_base (Code of the LaTeX+Markdown template)
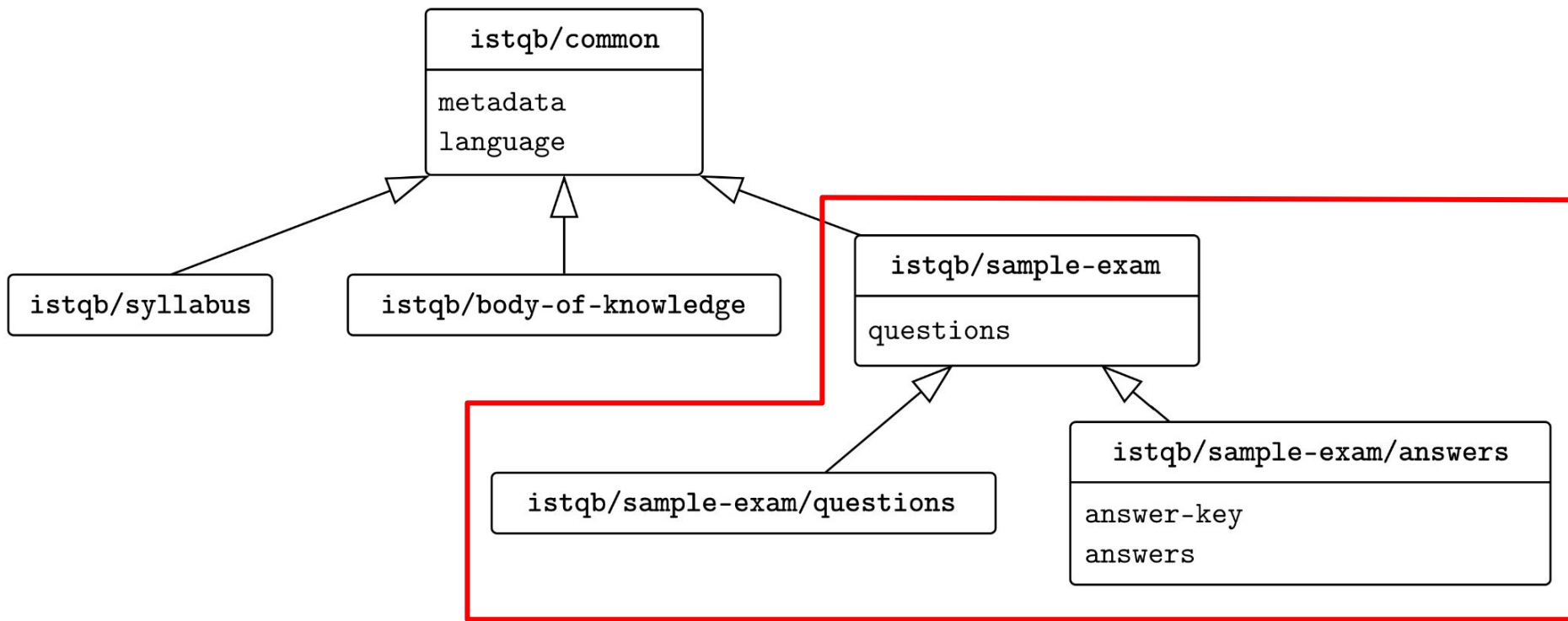
Figure 1: A class diagram of the six Markdown themes that I developed for the International Software Testing Qualifications Board (ISTQB). The snippets `metadata`, `language`, `questions`, `answer-key`, and `answers` specify the public interface of the themes and arrows specify inheritance.

1. Question Definitions

Here is an example file `questions.yml` with definitions for three questions:

```
[…]
questions:
  1:
    learning-objective: 1.2.3
    k-level: K1
    number-of-points: 1
    question: What is the answer to life, the universe, and everything?
    answers: {a: 24, b: 42, c: 64, d: 84}
    correct: [b]
    explanation: >
      The answer to life, the universe, and everything is a concept from Douglas Adams'
      science fiction series "The Hitchhiker's Guide to the Galaxy", where the supercomputer
      Deep Thought gives the answer 42.
  […]
```

```
[…]
5:
  learning-objective: 4.5.6
  k-level: K2
  number-of-points: 1
  question: What's France's capital?
  answers: {a: Berlin, b: Madrid, c: Paris, d: Rome}
  correct: [c]
  explanation: The capital of France is Paris, known for art, fashion, and culture.
6:
  learning-objective: 7.8.9
  k-level: K3
  number-of-points: 2
  question: Which two of the following animals are classified as mammals?
  answers: {a: Shark, b: Dolphin, c: Eagle, d: Whale, e: Crocodile}
  correct: [b, d]
  explanation: >
    Dolphins and whales are classified as mammals because they are warm-blooded,
    breathe with lungs, and feed their young milk.
```

2. **User Interface**   Typesetting Questions

Here is an example ISTQB Sample Exam Questions document in LaTeX:

```
\documentclass{istqb}
\usepackage{markdown}
\markdownSetup { import = {
  istqb/sample-exam/questions =
    questions as qst } }
\begin{document}
\istqbunnumberedsection{Questions}
\markdownInput[snippet=qst]{questions.yml}
\end{document}
```

The document imports snippet `questions` from theme `istqb/sample-exam/questions`
and uses it to 1. process file `questions.yml` and 2. typeset the list of questions from
Figure 2a on next slide.

Questions

Question #1 (1 Point)

What is the answer to life, the universe, and everything?

a) 24

b) 42

c) 64

d) 84

Select ONE option.

Question #5 (1 Point)

What's France's capital?

a) Berlin

b) Madrid

c) Paris

d) Rome

Select ONE option.

Question #6 (2 Points)

Which two of the following animals are classified as mammals?

a) Shark

b) Dolphin

c) Eagle

d) Whale

e) Crocodile

Select TWO options.

(a)

Answer key

Question Number (#)	Correct Answer	Learning Objective (LO)	K-Level	Number of Points
1	b	EXMPL-1.2.3	K1	1
5	c	EXMPL-4.5.6	K2	1
6	b, d	EXMPL-7.8.9	K3	2

(b)

Answers

Question Number (#)	Correct Answer	Explanation / Rationale	Learning Objective (LO)	K-Level	Number of Points
1	b	The answer to life, the universe, and everything is a concept from Douglas Adams' science fiction series "The Hitchhiker's Guide to the Galaxy", where the supercomputer Deep Thought gives the answer 42.	EXMPL-1.2.3	K1	1
5	c	The capital of France is Paris, known for art, fashion, and culture.	EXMPL-4.5.6	K2	1
6	b, d	Dolphins and whales are classified as mammals because they are warm-blooded, breathe with lungs, and feed their young milk.	EXMPL-7.8.9	K3	2

(c)

Figure 2: Three different ways to typeset question definitions in ISTQB Sample Exam Questions and Answers documents: a) a list of questions, b) an answer key, and c) a list of answers.

2. **User Interface**   Typesetting Answer Key and Answers

Here is an example ISTQB Sample Exam Answers document in LaTeX:

```
\documentclass{istqb}                    \istqblandscapebegin
\usepackage{markdown}                    \istqbunnumberedsection{Answer key}
\markdownSetup { import = {              \markdownInput[snippet=key]{questions.yml}
  istqb/sample-exam/answers =            \istqbunnumberedsection{Answers}
    answer-key as key,                   \markdownInput[snippet=ans]{questions.yml}
    answers as ans } }                   \istqblandscapeend
\begin{document}                         \end{document}
```

The document imports snippets `answers` and `answer-key` from theme `istqb/sample-
-exam/questions` and uses it to 1. process file `questions.yml`, 2. typeset the answer
key from Figure 2b on next slide, and 3. typeset the list of answers from Figure 2c on next slide.

Questions

Question #1 (1 Point)

What is the answer to life, the universe, and everything?

a) 24

b) 42

c) 64

d) 84

Select ONE option.

Question #5 (1 Point)

What's France's capital?

a) Berlin

b) Madrid

c) Paris

d) Rome

Select ONE option.

Question #6 (2 Points)

Which two of the following animals are classified as mammals?

a) Shark

b) Dolphin

c) Eagle

d) Whale

e) Crocodile

Select TWO options.

(a)

Answer key

Question Number (#)	Correct Answer	Learning Objective (LO)	K-Level	Number of Points
1	b	EXMPL-1.2.3	K1	1
5	c	EXMPL-4.5.6	K2	1
6	b, d	EXMPL-7.8.9	K3	2

(b)

Answers

Question Number (#)	Correct Answer	Explanation / Rationale	Learning Objective (LO)	K-Level	Number of Points
1	b	The answer to life, the universe, and everything is a concept from Douglas Adams' science fiction series "The Hitchhiker's Guide to the Galaxy", where the supercomputer Deep Thought gives the answer 42.	EXMPL-1.2.3	K1	1
5	c	The capital of France is Paris, known for art, fashion, and culture.	EXMPL-4.5.6	K2	1
6	b, d	Dolphins and whales are classified as mammals because they are warm-blooded, breathe with lungs, and feed their young milk.	EXMPL-7.8.9	K3	2

(c)

Figure 2: Three different ways to typeset question definitions in ISTQB Sample Exam Questions and Answers documents: a) a list of questions, b) an answer key, and c) a list of answers.
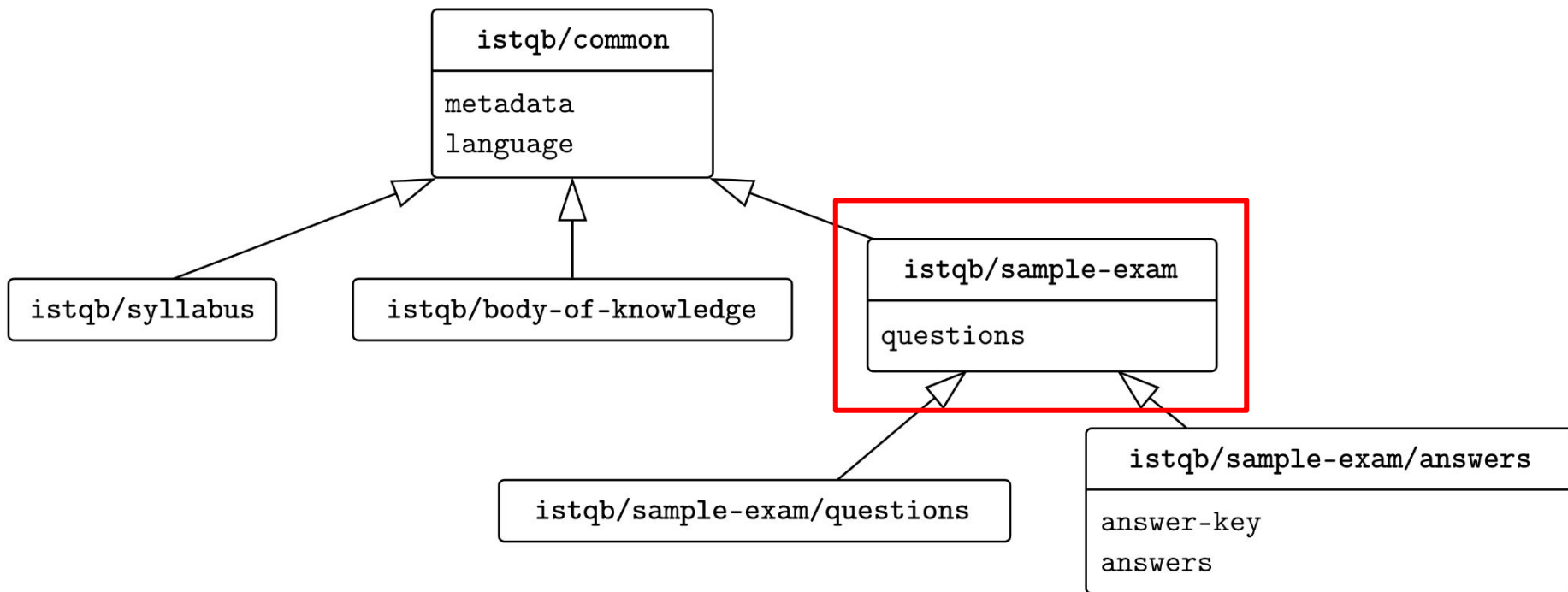
Contents

Figure 1: A class diagram of the six Markdown themes that I developed for the International Software Testing Qualifications Board (ISTQB). The snippets `metadata`, `language`, `questions`, `answer-key`, and `answers` specify the public interface of the themes and arrows specify inheritance.

3. **Implementation**   Processing Question Definitions

Snippet `questions` from `istqb/sample-exam` processes question definitions:

```
\markdownSetupSnippet
  { questions }
  { jekyllData, expectJekyllData,
    renderers = {
      jekyllData(Mapping|Sequence)Begin = {
        \str_case:nn
          { #1 } { { questions } {
                     \markdownSetup
                       { code = \group_begin:,
                         renderers = { jekyllData(Mapping|Sequence)End = },
                         snippet = istqb / sample-exam / questions / list,
                         renderers = { jekyllData(Mapping|Sequence)End += \group_end: }}}}}}}
```

```
[…]
questions:
  1:
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    […]
```

The snippet reads the field `questions` and calls snippet `questions/list`.

3. **Implementation**   Processing Question Definitions

Snippet `questions/list` processes individual questions:

```
\seq_new:N \g_istqb_questions_seq
\markdownSetupSnippet
  { questions / list }
  { renderers = {
      jekyllData(Mapping|Sequence)Begin = {
        \group_begin:
        \tl_set:Nn \l_istqb_current_question_tl { #1 }
        \seq_gput_right:Nn \g_istqb_questions_seq { #1 }
        \markdownSetup
          { renderers = { jekyllDataMappingEnd = },
            snippet = istqb / sample-exam / questions / *,
            renderers = { jekyllDataMappingEnd += \group_end: }}}}}}}
```

```
[…]
questions:
  1:
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    […]
```

The snippet stores question numbers and calls snippet `questions/*`.

3. **Implementation**   Processing Question Definitions

Snippet `questions/*` processes question fields:

```
\markdownSetupSnippet
  { questions / * }
  { renderers = {
      jekyllData(String|Number) = {
        \keys_set:nn { istqb / questions / * }
        { { #1 } = { #2 } }},
      },
      jekyllDataMappingBegin = { [call `questions/*/answers`] },
      jekyllDataSequenceBegin = { [″ `questions/*/correct`] }}}
```

```
[…]
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    question: What is the […]
    answers: {a: 24, …}
    correct: [b]
    explanation: The […]
  […]
```

The snippet 1. passes unstructured fields to key–value `istqb/questions/*`,
2. passes field `answers` to snippet `questions/*/answers`, and 3. passes field
`correct` to snippet `questions/*/correct`.

3. **Implementation** Processing Question Definitions

Key–value `istqb/questions/*` processes unstructured question fields:

```
\prop_new:N \g_istqb_question_learning_objective_prop
\prop_new:N \g_istqb_question_k_level_prop
\prop_new:N \g_istqb_question_number_of_points_prop
\prop_new:N \g_istqb_question_text_prop
\prop_new:N \g_istqb_question_explanation_prop
\keys_define:nn
  { istqb / questions / * }
  { learning-objective .code:n = {
      \prop_gput:NVn \g_istqb_question_number_of_points_prop
        \l_istqb_current_question_tl { #1 } },
    k-level […], number-of-points […], question […], explanation […] }
```

```
[…]
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    question: What is the […]
    answers: {a: 24, …}
    correct: [b]
    explanation: The […]
[…]
```

The key–value stores the values in dicts keyed by current question number.

3. **Implementation**   Processing Question Definitions

Snippet `questions/*/correct` processes field `correct`:

```
\prop_new:N \g_istqb_answer_correct_keys_prop
 \seq_new:N \l_istqb_current_answer_correct_keys_seq
\markdownSetupSnippet
  { questions / * / correct }
  { renderers = {
      jekyllData(String|Number) = {
        \seq_put_right:Nn
          \l_istqb_current_answer_correct_keys_seq { #2 } },
      jekyllDataSequenceEnd += {
        \clist_set_from_seq:NN \l_tmpa_clist
          \l_istqb_current_answer_correct_keys_seq
        \prop_gput:NVV \l_istqb_current_answer_correct_keys_seq
          \l_istqb_current_question_tl \l_tmpa_clist }}}
```

```
[…]
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    question: What is the […]
    answers: {a: 24, …}
    correct: [b]
    explanation: The […]
  […]
```

The snippet stores correct answer letters in a dict keyed by current question number.

3. **Implementation**   Processing Question Definitions

Snippet `questions/*/answers` processes field `answers`:

```
\prop_new:N \g_istqb_answer_keys_prop
\prop_new:N \g_istqb_answers_prop
 \seq_new:N \l_istqb_current_answer_keys_seq
\markdownSetupSnippet
  { questions / * / answers }
  { renderers = {
     jekyllData(String|Number) = {
        \seq_put_right:Nn \l_istqb_current_answer_keys_seq { #1 }
        \tl_set:NV \l_tmpa_tl \l_istqb_current_question_tl
        \tl_put_right:Nn \l_tmpa_tl { / #1 }
        \prop_gput:NVn \g_istqb_answers_prop \l_tmpa_tl { #2 } },
     jekyllDataMappingEnd += {
        \clist_set_from_seq:NN \l_tmpa_clist \l_istqb_current_answer_keys_seq
        \prop_gput:NVV \g_istqb_answer_keys_prop \l_istqb_current_question_tl \l_tmpa_clist }}}
```

```
[…]
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    question: What is the […]
    answers: {a: 24, …}
    correct: [b]
    explanation: The […]
[…]
```

The snippet 1. stores answer texts in a dict keyed by current question number `/` answer letter and 2. stores answer letters in a dict keyed by current question number.

3. **Implementation** Processing Question Definitions

Snippet `istqb/questions` has recursively produced the following data structures:

1. Sequence `\g_istqb_questions_seq` with all question numbers.
2. Dicts `\g_istqb_question_*_prop` with unstructured values.
3. Dicts `\g_istqb_answer*_keys_prop` with answer keys.
4. Dict `\g_istqb_answers_prop` with answer texts.

We can use these data structures to typeset questions, answer keys, and answers in subsequent themes:

```
[…]
  1:
    learning-objective: […]
    k-level: K1
    number-of-points: 1
    question: What is the […]
    answers: {a: 24, …}
    correct: [b]
    explanation: The […]
  …]
```

```
istqb/sample-exam/questions
```

```
istqb/sample-exam/answers
───────────────────────────
answer-key
answers
```

Questions

Question #1 (1 Point)

What is the answer to life, the universe, and everything?

a) 24

b) 42

c) 64

d) 84

Select ONE option.

Question #5 (1 Point)

What's France's capital?

a) Berlin

b) Madrid

c) Paris

d) Rome

Select ONE option.

Question #6 (2 Points)

Which two of the following animals are classified as mammals?

a) Shark

b) Dolphin

c) Eagle

d) Whale

e) Crocodile

Select TWO options.

Answer key

Question Number (#)	Correct Answer	Learning Objective (LO)	K-Level	Number of Points
1	b	EXMPL-1.2.3	K1	1
5	c	EXMPL-4.5.6	K2	1
6	b, d	EXMPL-7.8.9	K3	2

Answers

Question Number (#)	Correct Answer	Explanation / Rationale	Learning Objective (LO)	K-Level	Number of Points
1	b	The answer to life, the universe, and everything is a concept from Douglas Adams' science fiction series "The Hitchhiker's Guide to the Galaxy", where the supercomputer Deep Thought gives the answer 42.	EXMPL-1.2.3	K1	1
5	c	The capital of France is Paris, known for art, fashion, and culture.	EXMPL-4.5.6	K2	1
6	b, d	Dolphins and whales are classified as mammals because they are warm-blooded, breathe with lungs, and feed their young milk.	EXMPL-7.8.9	K3	2

For more information, see the [preprint][3].

[3]: https://tug.org/tug2024/preprints/starynovotny-markdown-themes.pdf

Conclusion

Although TeX has beautiful output, its input macro language is an acquired taste for many authors.

With the Markdown package, authors can type familiar Markdown and YAML and TeXperts can tailor the presentation with TeX.

In this talk, I showed how TeXperts can use _themes_ to write large stylesheets for Markdown and YAML documents.

Many thanks to ISTQB!   Questions?