SubVI Specifications for "Communication Systems Projects with LabVIEW"

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Online:

< http://cnx.org/content/col10608/1.2/ >

CONNEXIONS

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Chapter 1

General-Purpose Utilities

1.1 Bitstream sources

1.1.1 util BitstreamFromRandom.vi¹

odule refers to LabVIEW, a software development environment that features a graphical nming language. Please see the LabVIEW QuickStart Guide² module for tutorials and doction that will help you: Apply LabVIEW to Audio Signal Processing Terrtarted with LabVIEW • Obtain a fully-functional evaluation edition of LabVIEW

Table 1.1

NOTE: Visit LabVIEW Setup³ to learn how to adjust your own LabVIEW environment to match the settings used by the LabVIEW screencast video(s) in this module. Click the "Fullscreen" button at the lower right corner of the video player if the video does not fit properly within your browser window.

 $^{^{1}} This\ content\ is\ available\ online\ at\ < http://cnx.org/content/m18528/1.1/>.$

 $^{^2}$ "NI LabVIEW Getting Started FAQ" http://cnx.org/content/m15428/latest/ 3 "LabVIEW Setup for "Communication Systems Projects with LabVIEW"" http://cnx.org/content/m17319/latest/ 3 "LabVIEW" = 4 Communication Systems Projects with LabVIEW" = 4 Content/m17319/latest/

1.1.1.1 LabVIEW SubVI: util BitstreamFromRandom.vi

- **Description:** Generate a bitstream from a random number generator. The probability of generating a 1 can be controlled, as can the value of the random number seed.
- Category: General-purpose utility ("util" prefix)

1.1.1.2 Inputs (Controls)

- 1. length (128) -I32
- 2. ones probability (0.5) $-\,\mathrm{DBL}$
- 3. seed (-1) I32

Parentheses () indicate default value; square brackets [] designate units.

1.1.1.3 Outputs (Indicators)

1. bitstream out - 1-D Boolean array

1.1.1.4 Required Behavior

- The bitstream length defaults to 128 bits.
- A "seed" value of -1 indicates that a new set of random bits should be generated each time the subVI is called. Positive seed values will cause the same pattern to be generated each time, with the particular seed value selecting a different pattern.

1.1.1.5 LabVIEW Coding Tips

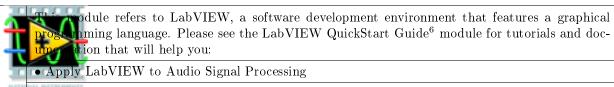
View the screencast video in Create a SubVI in LabVIEW⁴ to learn the mechanics of subVIs.

Refer to the Figure 1.1 screencast video for LabVIEW coding tips and techniques specific to this subVI.

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Figure 1.1: [video] LabVIEW coding tips and techniques for util_BitstreamFromRandom.vi

1.1.2 util_BitstreamFromText.vi⁵



LabVIEW with LabVIEW

• Obtain a fully-functional evaluation edition of LabVIEW

Table 1.2

NOTE: Visit LabVIEW Setup⁷ to learn how to adjust your own LabVIEW environment to match the settings used by the LabVIEW screencast video(s) in this module. Click the "Fullscreen" button at the lower right corner of the video player if the video does not fit properly within your browser window.

^{4&}quot;Create a SubVI in LabVIEW" http://cnx.org/content/m14767/latest/

⁵This content is available online at http://cnx.org/content/m18631/1.1/>.

^{6&}quot;NI LabVIEW Getting Started FAQ" http://cnx.org/content/m15428/latest/

^{7&}quot;LabVIEW Setup for "Communication Systems Projects with LabVIEW"" http://cnx.org/content/m17319/latest/

1.1.2.1 LabVIEW SubVI: util BitstreamFromText.vi

- **Description:** Generate a bitstream from a sequence of text characters. Framing bits (start bit and stop bit) may optionally be added to the bitstream. The bitstream is also available in the form of a wordstream.
- Category: General-purpose utility ("util" prefix)

1.1.2.2 Inputs (Controls)

- 1. text string
- $2.\ insert$ framing bits (F) $-\ \mathrm{Boolean}$
- 3. start bit value (T) Boolean

Parentheses () indicate default value; square brackets [] designate units.

1.1.2.3 Outputs (Indicators)

- 1. bitstream out 1-D Boolean array
- 2. wordstream out -2-D Boolean array

1.1.2.4 Required Behavior

- Converted text follows the indexing schemes imposed by the LabVIEW built-in nodes "String to Byte Array" and "Number to Boolean Array."
- When requested, the "start bit value" will be prepended to the 8-bit Boolean value, and the complement of the "start bit value" will be appended to the 8-bit Boolean value.
- The wordstream is an Nx8 2-D version of the 1-D bitstream (Nx10 if framing bits have been inserted), where "N" is the number of characters in the text control.

1.1.2.5 LabVIEW Coding Tips

View the screencast video in Create a SubVI in LabVIEW⁸ to learn the mechanics of subVIs.

Refer to the Figure 1.2 screencast video for LabVIEW coding tips and techniques specific to this subVI.

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Figure 1.2: [video] LabVIEW coding tips and techniques for util_BitstreamFromText.vi

1.2 Bitstream conversion

1.2.1 util BitsToWords.vi⁹

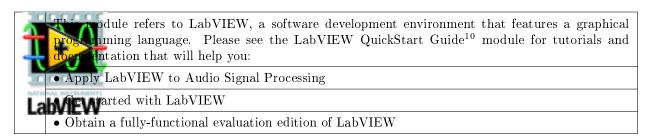


Table 1.3

NOTE: Visit LabVIEW Setup¹¹ to learn how to adjust your own LabVIEW environment to match the settings used by the LabVIEW screencast video(s) in this module. Click the "Fullscreen" button at the lower right corner of the video player if the video does not fit properly within your browser window.

^{8&}quot;Create a SubVI in LabVIEW" http://cnx.org/content/m14767/latest/

⁹This content is available online at http://cnx.org/content/m18596/1.1/>.

 $^{^{10}}$ "NI LabVIEW Getting Started FAQ" $<\!\!$ http://cnx.org/content/m15428/latest/>

^{11 &}quot;LabVIEW Setup for "Communication Systems Projects with LabVIEW"" http://cnx.org/content/m17319/latest/

1.2.1.1 LabVIEW SubVI: util BitsToWords.vi

- **Description:** Convert a bitstream into a wordstream (sequence of k-bit words) by reshaping a 1-D Boolean array into a 2-D Boolean array.
- Category: General-purpose utility ("util" prefix)

1.2.1.2 Inputs (Controls)

- 1. bitstream in 1-D Boolean array
- 2. k, word size -I32

Parentheses () indicate default value; square brackets [] designate units.

1.2.1.3 Outputs (Indicators)

1. wordstream out -2-D Boolean array

1.2.1.4 Required Behavior

- The inbound bitstream of length N produces an outbound wordstream (2-D array) of dimension (N/k) by k, where k is the wordsize.
- When N is not an integer multiple of k, the wordstream will be padded with Boolean "False" value.

1.2.1.5 LabVIEW Coding Tips

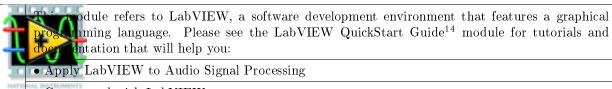
View the screencast video in Create a SubVI in LabVIEW¹² to learn the mechanics of subVIs.

Refer to the Figure 1.3 screencast video for LabVIEW coding tips and techniques specific to this subVI.

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Figure 1.3: [video] LabVIEW coding tips and techniques for util BitsToWords.vi

1.2.2 util WordsToBits.vi¹³



LabVIEW

• Obtain a fully-functional evaluation edition of LabVIEW

Table 1.4

NOTE: Visit LabVIEW Setup¹⁵ to learn how to adjust your own LabVIEW environment to match the settings used by the LabVIEW screencast video(s) in this module. Click the "Fullscreen" button at the lower right corner of the video player if the video does not fit properly within your browser window.

 $^{^{12}}$ "Create a SubVI in LabVIEW" http://cnx.org/content/m14767/latest/

¹³This content is available online at http://cnx.org/content/m18551/1.1/>.

¹⁴"NI LabVIEW Getting Started FAQ" http://cnx.org/content/m15428/latest/>

^{15&}quot;LabVIEW Setup for "Communication Systems Projects with LabVIEW"" http://cnx.org/content/m17319/latest/

1.2.2.1 LabVIEW SubVI: util WordsToBits.vi

- **Description:** Convert a wordstream (sequence of k-bit words) into a bitstream by reshaping a 2-D Boolean array into a 1-D Boolean array.
- Category: General-purpose utility ("util" prefix)

1.2.2.2 Inputs (Controls)

1. wordstream in -2-D Boolean array

Parentheses () indicate default value; square brackets [] designate units.

1.2.2.3 Outputs (Indicators)

1. bitstream out - 1-D Boolean array

1.2.2.4 Required Behavior

• The inbound wordstream (2-D array) of dimension (N/k) by k, where k is the wordsize, produces an outbound bitstream of length N.

1.2.2.5 LabVIEW Coding Tips

View the screencast video in Create a SubVI in LabVIEW¹⁶ to learn the mechanics of subVIs.

Refer to the Figure 1.4 screencast video for LabVIEW coding tips and techniques specific to this subVI.

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Figure 1.4: [video] LabVIEW coding tips and techniques for util_WordsToBits.vi

1.2.3 util BitstreamToText.vi¹⁷

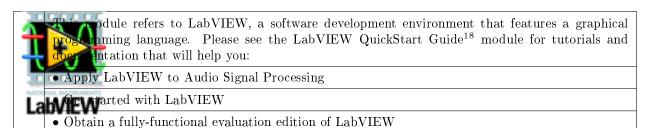


Table 1.5

NOTE: Visit LabVIEW Setup¹⁹ to learn how to adjust your own LabVIEW environment to match the settings used by the LabVIEW screencast video(s) in this module. Click the "Fullscreen" button at the lower right corner of the video player if the video does not fit properly within your browser window.

¹⁶"Create a SubVI in LabVIEW" http://cnx.org/content/m14767/latest/

¹⁷This content is available online at http://cnx.org/content/m18629/1.1/>.

¹⁸"NI LabVIEW Getting Started FAQ" http://cnx.org/content/m15428/latest/

^{19 &}quot;LabVIEW Setup for "Communication Systems Projects with LabVIEW"" http://cnx.org/content/m17319/latest/

1.2.3.1 LabVIEW SubVI: util BitstreamToText.vi

- **Description:** Interpret a bitstream as a sequence of text characters. Framing bits (start bit and stop bit) may optionally have been added to the bitstream, and are removed. Framing errors (mismatch between expected and actual values of framing bits) are indicated.
- Category: General-purpose utility ("util" prefix)

1.2.3.2 Inputs (Controls)

- 1. bitstream in Boolean 1-D array
- 2. includes framing bits (F) Boolean
- 3. start bit value (T) Boolean

Parentheses () indicate default value; square brackets [] designate units.

1.2.3.3 Outputs (Indicators)

- 1. text out string
- 2. framing error? 1-D Boolean array

1.2.3.4 Required Behavior

- The bitstream must follow the indexing schemes imposed by the LabVIEW built-in nodes "Boolean Array to Number" and "Byte Array to String."
- When includes framing bits is true, the start bit leading the 8-element Boolean subarray (a single text character) and the trailing stop bit will be removed from the bitstream before converting to text. In addition, the start bit will be compared to the expected value start bit value; the same holds true for the stop bit, which is assumed to be the complement of start bit value. Any mismatch is to be flagged as a framing error by setting framing error? true.

1.2.3.5 LabVIEW Coding Tips

View the screencast video in Create a SubVI in LabVIEW²⁰ to learn the mechanics of subVIs.

Refer to the Figure 1.5 screencast video for LabVIEW coding tips and techniques specific to this subVI.

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Figure 1.5: [video] LabVIEW coding tips and techniques for util_BitstreamToText.vi

1.3 Channel noise

1.3.1 util BinarySymmetricChannel.vi²¹

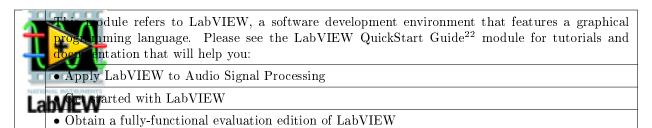


Table 1.6

NOTE: Visit LabVIEW Setup²³ to learn how to adjust your own LabVIEW environment to match the settings used by the LabVIEW screencast video(s) in this module. Click the "Fullscreen" button at the lower right corner of the video player if the video does not fit properly within your browser window.

 $^{^{20}}$ "Create a SubVI in LabVIEW" http://cnx.org/content/m14767/latest/

 $^{^{21}}$ This content is available online at <http://cnx.org/content/m18537/1.1/>.

 $^{^{22} &}quot;NI\ LabVIEW\ Getting\ Started\ FAQ"\ http://cnx.org/content/m15428/latest/$

²³"LabVIEW Setup for "Communication Systems Projects with LabVIEW"" http://cnx.org/content/m17319/latest/

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