Form Operators and Functions

Expressions in calculations, constraints, and relevants can contain operators and functions.

Operators

Math operators

	Explanation	Example
+	addition	${salary_income} + ${self_employed_income}
-	subtraction	${income} - ${expenses}
*	multiplication	${bill} * 1.18
div	division	${percent_int} div 100
mod	modulo (division remainder)	(${even_number} mod 2) = 0

Warning

Math operators only work with numbers.

- The addition operator cannot be used to concatenate strings. Use the `concat()` function instead.
- Empty values (that is, variables referencing unanswered questions) are actually empty strings, and will not be automatically converted to zero (0).

Comparison operators

Comparison operators are used to compare values. The result of a comparison is always `True` or `False`.

	Explanation	Example	Notes
=	equal to	${enrolled} = 'yes'	Can compare numbers or strings.
!=	not equal to	${enrolled} != 'yes'	Can compare numbers or strings.
>	greater than	${age} > 17	
>=	greater than or equal to	${age} >= 18	
<	less than	${age} < 65	
<=	less than or equal to	${age} <= 64	

Warning

- The relational operators (`>`, `>=`, `<`, `<=`) only work with numbers.
- Empty response values are not automatically converted to zero (0).

Boolean operators

Boolean operators combine two `True` or `False` values into a single `True` or `False` value.

	Explanation	Example
and	`True` if the expressions before and after are `True`	${age} > -1 and ${age} < 120
or	`True` if either of the expressions before or after are `True`	${age} < 19 or ${age} > 64

Path operators

	Explanation	Example	Notes
.	current question's value	. >= 18	Used in constraints.

> **Note**
>
> Formally, these are not operators but rather XPath references to the current node (`.`) and the parent node (`..`). XPath paths can be used to reference nodes of a form.

Functions

> **See also**
>
> Functions in the ODK XForm Specification

Control flow

`if(expression, then, else)`

Returns `then` if `expression` evaluates to `True`. Otherwise, returns `else`.

`position(xpath)`

Returns an integer equal to the 1-indexed position of the current node within the node defined by `xpath`.

Most often this is used in the form `position(..)` to identify the current iteration index within a repeat group.

XLSFORM

type	name	label	repeat_count	calculation
note	person_list_note	Please list the names of the people in your household.		
begin_repeat	person	Member of household		
text	name	Name		
end_repeat				
begin_repeat	person_details	Details	count(${person})	
calculate	current_name			indexed-repeat(${name}, ${person}, position(..))
date	member_bday	Birthday of ${current_name}		
end_repeat				

`once(expression)`

Returns the value `expression` if the question's value is empty. Otherwise, returns the current value of the question.

This can be used to ensure that a random number is only generated once, or to store the first value entered for a question in a way that is retrievable even if the response is changed later.

> **Warning**
>
> This function is often misunderstood. Read when expressions are evaluated to learn more.

Accessing response values

> **Note**
>
> The response from most question types can be accessed using variables. Functions are needed for accessing responses to multi select questions and questions inside repeat groups.

Select questions

`selected(space_delimited_array, string)`

Returns `True` if `string` is a member of `space_delimited_array`, otherwise returns `False`.

Commonly used to determined if a specific choice was selected in a select question. (This is possible because a

reference to a select question returns a space-delimited array of choice names.)

XLSFORM

survey

type	name	label	hint	relevant	constr
select_multiple medical_issues	what_issues	Have you experienced any of the following?	Select all that apply.		
select_multiple cancer_types	what_cancer	What type of cancer have you experienced?	Select all that apply.	selected(${what_issues}, 'cancer')	
select_multiple diabetes_types	what_diabetes	What type of diabetes do you have?	Select all that apply.	selected(${what_issues}, 'diabetes')	
begin_group	blood_pressure	Blood pressure reading	selected(${what_issues}, 'hypertension')		
integer	systolic_bp	Systolic			. > 40 a . < 400
integer	diastolic_bp	Diastolic			. >= 20 and . < 200
end_group					
text	other_health	List other issues.		selected(${what_issues}, 'other')	
note	after_health_note	This note is after all health questions.			

choices

list_name	name	label
medical_issues	cancer	Cancer
medical_issues	diabetes	Diabetes

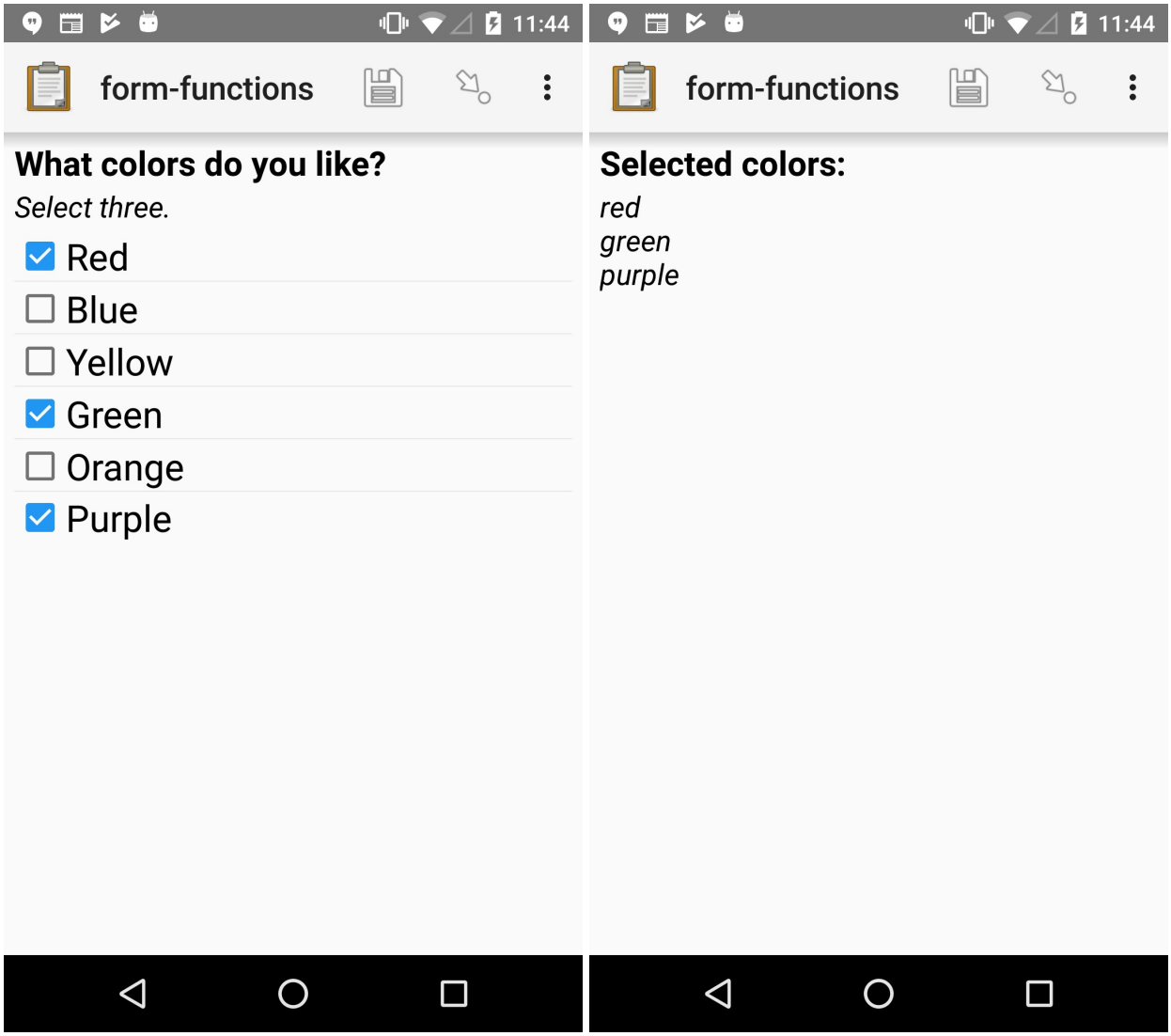
medical_issues	hypertension	Hypertension
medical_issues	other	Other
cancer_types	lung	Lung cancer
cancer_types	skin	Skin cancer
cancer_types	prostate	Prostate cancer
cancer_types	breast	Breast cancer
cancer_types	other	Other
diabetes_types	type_1	Type 1 (Insulin dependent)
diabetes_types	type_2	Type 2 (Insulin resistant)

`selected-at(space_delimited_array, n)`

Returns the string at the `n` th position of the `space_delimited_array`. (The array is zero-indexed.) Returns an empty string if the index does not exist.

This can be used to get the `name` of a selected choice from a multi-select question. (This is possible because a reference to a select question returns a space-delimited array of choice names.)

> **Note**
>
> If used to get a choice name from a select question, this function returns the `name`, not the `label`, of the selected choice. To get the label in the current language, use `jr:choice-name()`.



survey

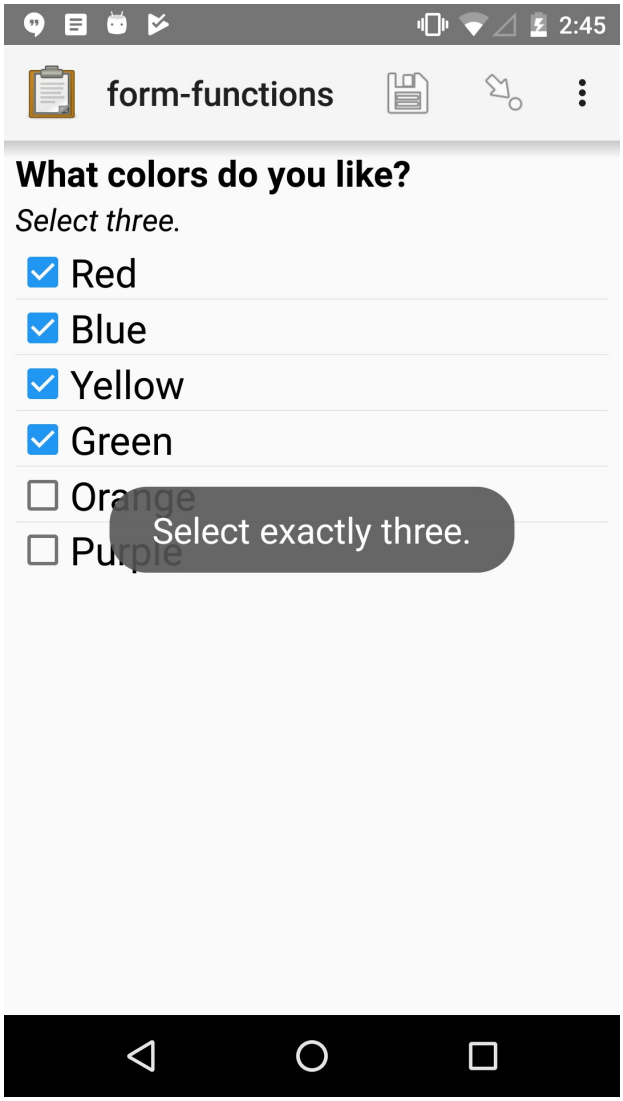
type	name	label	hint	calculation
select_multiple colors	color_prefs	What colors do you like?	Select three.	
calculate	color_0			selected-at(${color_prefs}, 0)
calculate	color_1			selected-at(${color_prefs}, 1)
calculate	color_2			selected-at(${color_prefs}, 2)
note	color_note	Selected colors:	${color_0} ${color_1} ${color_2}	

choices

list_name	name	label
colors	red	Red
colors	blue	Blue
colors	yellow	Yellow
colors	green	Green
colors	orange	Orange
colors	purple	Purple

`count-selected(multi_select_question)`

Returns the number of choices selected in `multi_select_question`.



XLSFORM

survey

type	name	label	hint	constraint	constraint_message
select_multiple colors	color_prefs	What colors do you like?	Select three.	count-selected(.)=3	Select exactly three.

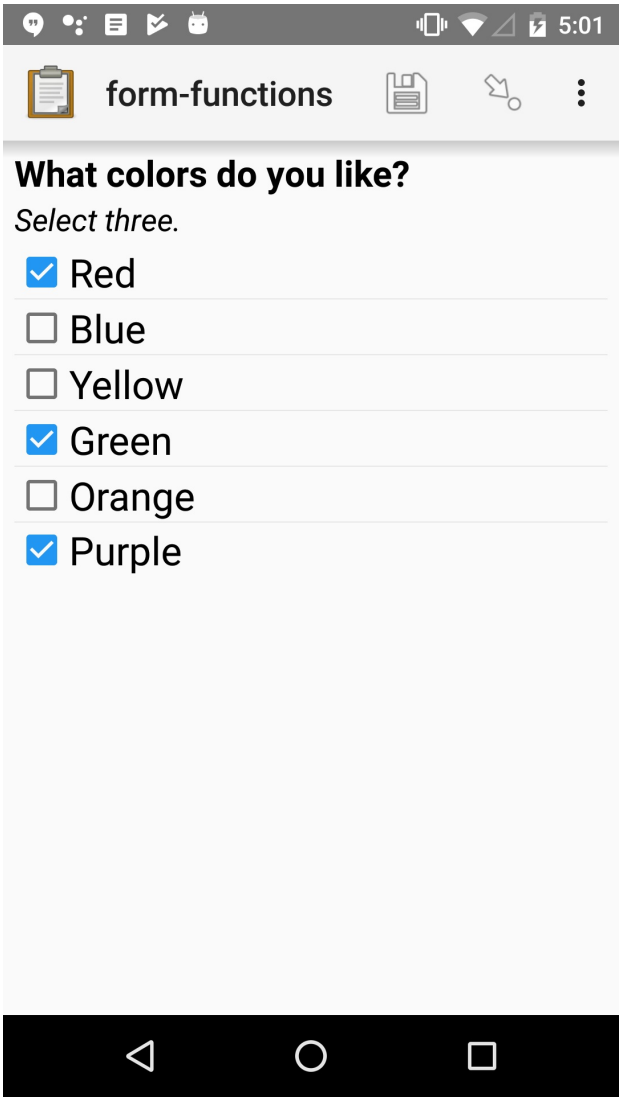
choices

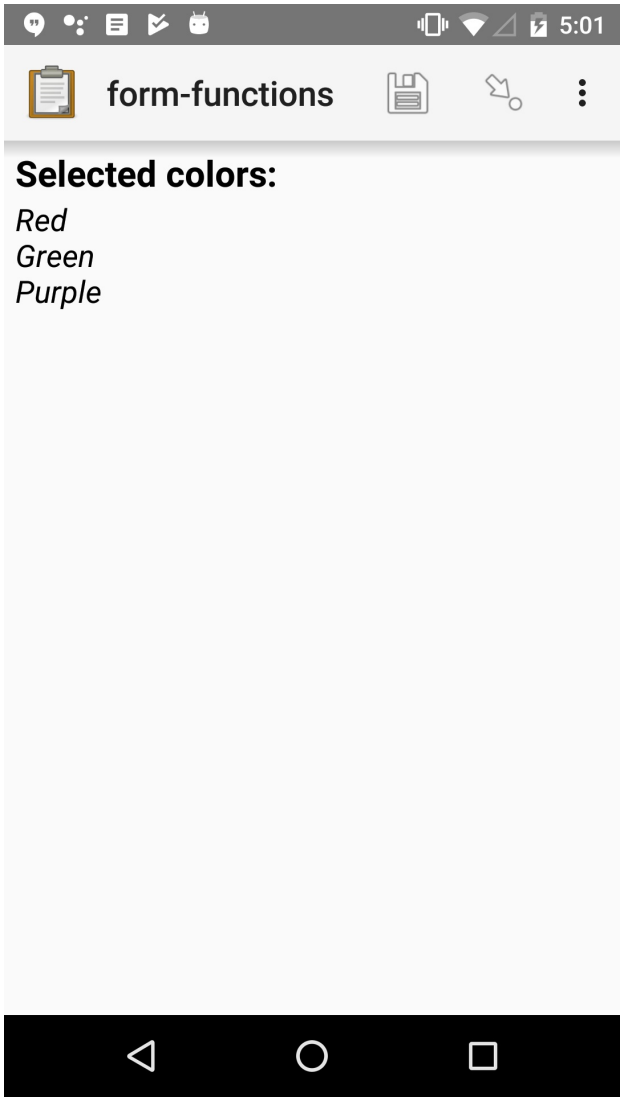
list_name	name	label
colors	red	Red
colors	blue	Blue
colors	yellow	Yellow
colors	green	Green
colors	orange	Orange
colors	purple	Purple

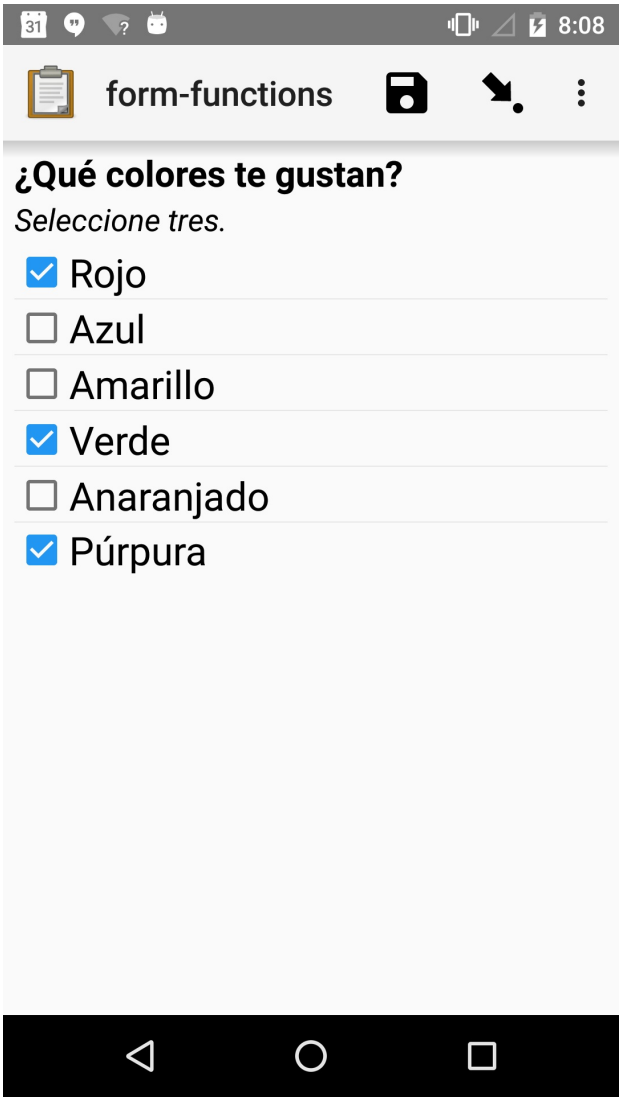
`jr:choice-name(choice_name, 'select_question')`

Returns the label value, in the active language, associated with the `choice_name` in the list of choices for the `select_question`.

> **Note**
>
> You have to wrap the `select_question` reference in quotes.
>
> ```
> '${question_name}'
> ```


5:01
form-functions
What colors do you like?
Select three.
Red
Blue
Yellow
Green
Orange
Purple


5:01
form-functions
Selected colors:
Red
Green
Purple



XLSFORM

survey

type	name	label::English	label::Español	hint::English	hint:Español	calculation
select_multiple colors	color_prefs	What colors do you like?	¿Qué colores te gustan?	Select three.	Seleccione tres.	
calculate	color_0					jr:choice-name(selected-at(${color_prefs} 0), '${color_prefs}')
calculate	color_1					jr:choice-name(selected-at(${color_prefs} 1), '${color_prefs}')
calculate	color_2					jr:choice-name(selected-at(${color_prefs} 2), '${color_prefs}')
note	color_note	Selected colors:	Colores seleccionados:	${color_0} ${color_1} ${color_2}	${color_0} ${color_1} ${color_2}	

choices

list_name	name	label::English	label::Español
colors	red	Red	Rojo
colors	blue	Blue	Azul
colors	yellow	Yellow	Amarillo
colors	green	Green	Verde
colors	orange	Orange	Anaranjado
colors	purple	Purple	Púrpura

Repeat groups

Helpful terms

nodeset

A collection of XML nodes. In XLSForms, this is typically a collection of response values.

Outside a repeat group, referring to a question by name will return a nodeset containing all the responses to that question.

Nodesets can also be created by joining two or more nodes with pipes: `/data/age | /data/name`.

`indexed-repeat(name, group, i [, sub_grp, sub_i [, sub_sub_grp, sub_sub_i ]])`

Returns the response value of question `name` from the repeat-group `group`, in iteration `i`.

Nested repeat groups can be accessed using the `sub` and `sub_sub` parameters.

See also

Referencing repeated questions from inside the repeat

XLSFORM

type	name	label	repeat_count	calculation
note	person_list_note	Please list the names of the people in your household.		
begin_repeat	person	Member of household		
text	name	Name		
end_repeat				
begin_repeat	person_details	Details	count(${person})	
calculate	current_name			indexed-repeat(${name}, ${person}, position(..))
date	member_bday	Birthday of ${current_name}		
end_repeat				

`count(nodeset)`

Returns the number of items in `nodeset`. This can be used to count the number of repetitions in a repeat group.

XLSFORM

type	name	label	repeat_count	calculation
note	person_list_note	Please list the names of the people in your household.		
begin_repeat	person	Member of household		
text	name	Name		
end_repeat				
begin_repeat	person_details	Details	count(${person})	
calculate	current_name			indexed-repeat(${name}, ${person}, position(..))
date	member_bday	Birthday of ${current_name}		
end_repeat				

`count-non-empty(nodeset)`

Returns the number of non-empty members of `nodeset`.

`sum(nodeset)`

Returns the sum of the members of `nodeset`.

Can be used to tally responses to a repeated select question.

XLSFORM

survey

type	name	label	calculation
begin_repeat	guest_details	Guest details	
text	guest_name	Guest name	
select_one meal_options	meal_preference	Meal preference	
calculate	chkn		if(${meal_preference} = 'chicken', 1, 0)
calculate	fsh		if(${meal_preference} = 'fish', 1, 0)
calculate	veg		if(${meal_preference} = 'vegetarian', 1, 0)
end_repeat			
calculate	chkn_count		sum(${chkn})
calculate	fsh_count		sum(${fsh})
calculate	veg_count		sum(${veg})

choices

list_name	name	label
meal_options	chicken	Chicken
meal_options	fish	Fish
meal_options	vegetarian	Vegetarian

max(nodeset)

Returns the largest member of `nodeset`.

XLSFORM

survey

type	name	label	calculation
begin_repeat	child_questions	Questions about child	
text	child_name	Child's name	
integer	child_age	Child's age	
end_repeat			
calculate	age_of_oldest_child		max(${child_age})

min(nodeset)

Returns the smallest member of `nodeset`.

XLSFORM

survey

type	name	label	calculation
begin_repeat	child_questions	Questions about child	
text	child_name	Child's name	
integer	child_age	Child's age	
end_repeat			
calculate	age_of_youngest_child		min(${child_age})

Warning

The `min()` and `max()` functions only work sets of numbers. Empty values (that is, variables referencing unanswered questions) are actually empty strings, and will not be automatically converted to zero (0).

Strings

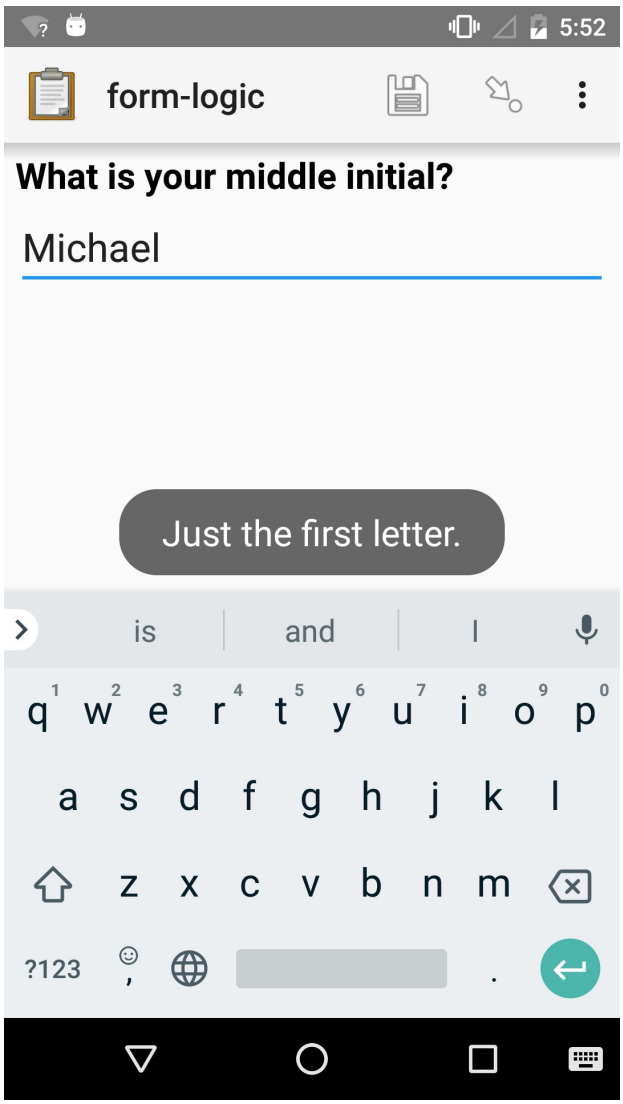
Searching and matching strings

regex(string, expression)

Returns `True` if `string` is an *exact and complete* match for `expression`.

See also

Using regular expressions



XLSFORM

survey

type	name	label	constraint	constraint_message
text	middle_initial	What is your middle initial?	regex(., 'p{L}')	Just the first letter.

contains(string, substring)

Returns `True` if the `string` contains the `substring`.

starts-with(string, substring)

Returns `True` if `string` begins with `substring`.

ends-with(string, substring)

Returns `True` if the `string` ends with `substring`.

substr(string, start[, end])

Returns the substring of `string` beginning at the index `start` and extending to (but not including) index `end` (or to the termination of `string`, if `end` is not provided). Members of `string` are zero-indexed.

`substring-before(string, target)`

Returns the substring of `string` *before* the first occurrence of the `target` substring. If the `target` is not found, or `string` begins with the `target` substring, then this will return an empty string.

`substring-after(string, target)`

Returns the substring of `string` *after* the first occurrence of the `target` substring. If the `target` is not found this will return an empty string.

`translate(string, fromchars, tochars)`

Returns a copy of `string`, where every occurrence of a character in `fromchars` is replaced by the corresponding character in `tochars`. If `fromchars` is longer than `tochars` then every occurrence of a character in `fromchars` that does not have a corresponding character in `tochars` will be removed.

`string-length(string)`

Returns the number of characters in `string`. If no value is passed in, returns the number of characters in the value of the question that this function call is tied to which can be useful in a `constraint` expression.

`normalize-space(string)`

Returns a string with normalized whitespace by stripping leading and trailing whitespace of `string` and replacing sequences of whitespace characters with a single space. If no value is passed in, normalizes whitespace of the value of the question that this function call is tied to.

Combining strings

`concat(arg [, arg [, arg [, arg [...]]]])`

Concatenates one or more arguments into a single string. If any `arg` is a nodeset, the values within the set are concatenated into a string.

`join(separator, nodeset)`

Joins the members of `nodeset`, using the string `separator`.

Converting to and from strings

`boolean-from-string(string)`

Returns `True` if `string` is "true" or "1". Otherwise, `False`.

`string(arg)`

Converts `arg` to a string.

Math

> ⚠ Warning
>
> Math functions (except `number()`) only work with number values.
>
> You can use `number()` to convert a string of digits to a number, but it is usually better to get a number value directly.
>
> Empty values (that is, variables referencing unanswered questions) are actually empty strings, and will not be automatically converted to zero (0).

Number handling

`round(number, places)`

Rounds a decimal `number` to some number of decimal `places`.

`int(number)`

Truncates the fractional portion of a decimal `number` to return an integer.

number(arg)

Converts `arg` to number value.

If `arg` is a string of digits, returns the number value.

If `arg` is `True`, returns 1. If `arg` is `False`, returns 0.

If `arg` cannot be converted, returns `NaN` (not a number).

digest(data, algorithm, encoding method (optional))

Computes and returns the hash value of the data `string` using the indicated hash algorithm `string`, and encoding this hash value using the optional encoding `string`.

Options for the algorithm are `MD5`, `SHA-1`, `SHA-256`, `SHA-384`, `SHA-512`.

If the third parameter is not specified, the encoding is `base64`. Valid options for the encoding are `base64` and `hex`.

This function can be useful if, for example, someone wants to build a unique identifier from sensitive data like a national ID number without compromising that data.

See also

`count()`, `max()`, `min()`, `number()`

Calculation

pow(number, power)

Raises a `number` to a `power`.

log(number)

Returns the natural log of `number`.

log10(number)

Returns the base-10 log of `number`.

abs(number)

Returns the absolute value of `number`.

sin(number)

Returns the sine of `number`.

cos(number)

Returns the cosine of `number`.

tan(number)

Returns the tangent of `number`.

asin(number)

Returns the arc sine of `number`.

acos(number)

Returns the arc cosine of `number`.

atan(number)

Returns the arctan of `number`.

atan2(y, x)

Returns the multi-valued inverse tangent of `y`, `x`.

sqrt(number)

Returns the square root of `number`.

exp(x)

Returns `e^x`.

exp10(x)

Returns `10^x`.

pi()

Returns an approximation of the mathematical constant π.

Date and time

today()

Returns the current date without a time component.

now()

Returns the current datetime in ISO 8601 format, including the timezone.

> ⚠ Warning
>
> This function is often misused. Read when expressions are evaluated to learn more.

Converting dates and time

decimal-date-time(dateTime)

Converts `dateTime` value to the number of days since January 1, 1970 (the Unix Epoch).

This is the inverse of `date()`.

date(days)

Converts an integer representing a number of `days` from January 1, 1970 (the Unix Epoch) to a standard date value.

This is the inverse of `decimal-date-time()`.

decimal-time(time)

Converts `time` to a number representing a fractional day. For example, noon is 0.5 and 6:00 PM is 0.75.

Formatting dates and times for display

format-date(date, format)

Returns `date` as a string formatted as defined by `format`.

The following identifiers are used in the `format` string:

%Y	4-digit year
%y	2-digit year
%m	0-padded month
%n	numeric month
%b	short text month (Jan, Feb, Mar…)
%d	0-padded day of month
%e	day of month
%a	short text day (Sun, Mon, Tue…).

> 🖉 Note
>
> Month and day abbreviations are language and locale specific. If form locale can be determined, that locale will be used. Otherwise, the device locale will be used.

`format-date-time(dateTime, format)`

Returns `dateTime` as a string formatted as defined by `format`.

The identifiers list in `format-date()` are available, plus the following:

%H	0-padded hour (24-hr time)
%h	hour (24-hr time)
%M	0-padded minute
%S	0-padded second
%3	0-padded millisecond ticks.

Geography

`area(nodeset | geoshape)`

Returns the area, in square meters, of either a `nodeset` of geopoints or a `geoshape` value.

It takes into account the circumference of the Earth around the Equator but does not take altitude into account.

`distance(nodeset | geoshape | geotrace)`

Returns the distance, in meters, of either:

- a `nodeset` of geopoints
- the perimeter of a `geoshape`
- the length of a `geotrace` value

It takes into account the circumference of the Earth around the Equator and does not take altitude into account.

Utility

`random()`

Returns a random number between 0.0 (inclusive) and 1.0 (exclusive).

> ⚠ Warning
>
> This function is often misused. Read when expressions are evaluated to learn more.

`randomize(nodeset[, seed])`

Returns a shuffled `nodeset`.

A shuffle with a numeric `seed` is deterministic and reproducible.

The primary use for this function is to randomize the order of choices for a select question. The documentation on select widgets describes how this is done in XLSForm.

`randomize()` can only be used in a context where a `nodeset` is accepted. Note that questions of type **calculate** cannot reference a `nodeset`.

`uuid([length])`

Without argument, returns a random RFC 4122 version 4 compliant UUID.

With an argument it returns a random GUID of specified `length`.

boolean(arg)

Returns `True` if `arg` is:

- a number other than zero
- a non-empty string
- a non-empty collection
- a comparison or expressions that evaluates to `True`.

Returns `False` if `arg` is:

- the number 0
- an empty string
- an empty collection
- a comparison or expression that evaluates to `False`.

not(arg)

Returns the opposite of `boolean(arg)`.

coalesce(arg, arg)

Returns first non-empty value of the two `arg`s. Returns an empty string if both are empty or non-existent.

checklist(min, max, response[, response[, response[, ...]]])

Returns `True` if the number of `response`s that are exactly the string "yes" is between `min` and `max`, inclusive.

Set `min` or `max` to `-1` to make the argument not applicable.

weighted-checklist(min, max, reponse, weight[, response, weight[, response, weight[, response, weight[, ...]]])

Returns `True` if the sum of the `weight`s of each `response` that is exactly the string "yes" is between `min` and `max`, inclusive.

Set `min` or `max` to `-1` to make the argument not

true()

Evaluates to `True`.

false()

Evaluates to `False`.