We are planning to add the following features of the random sampling to Array.

1. Weighted random sampling.
2. Sampling with replacement.
3. Iteration.

It is discussed in ruby-dev (Feature #3647 and #4147).

API will be:

Array#sample([size, [opt]])

- Random selection without replacement.
- Returns a new array when size is specified.
- opt: weight: proc or array   random: Random instance

Array#choice([size, [opt]])

- Random selection with replacement.
- Returns a new array when size is specified.
- opt: same as above.

Array#each_sample([opt])

- Random selection iterator without replacement.
- Choose a random element and yield it.
- Returns an Enumerator if a block is not given.
- opt: same as above.

Array#each_choice([opt])

- Random selection iterator with replacement.
- Choose a random element and yield it.
- Returns an Enumerator if a block is not given.
- opt: same as above.

Comments?

Related issues:

Related to Ruby master - Feature #3647: Array#sample(n, replace=false) Feedback
Related to Ruby master - Feature #4147: Array#sample 00000000 Feedback

History

#1 - 01/07/2011 08:08 PM - mame (Yusuke Endoh)

Hi,

2011/1/7 Yoji Ojima redmine@ruby-lang.org:

We are planning to add the following features of the random sampling to Array.

1. Weighted random sampling.
2. Sampling with replacement.
3. Iteration.

It is discussed in ruby-dev (Feature #3647 and #4147).

I'm adding complementary information.

There are two reasons why the name "choice" is selected:

- For backward compatibility. Once upon a time, trunk (before 1.9.0) had provided Array#choice. It was backported to 1.8.7. Then, in trunk, the name was changed to Array#sample (see the thread from [ruby-core:18036]). But 1.8.7 still provides Array#choice because it cannot remove Array#choice for compatibility reason. Note that 1.8.7's Array#choice does not receive any argument, so there is no compatibility problem.

- Mathematica provides RandomSample and RandomChoice for SRSWOR and SRSWR, respectively
  

There are some algorithms [1] [2] for fast multiple sampling.

[1] Pavlos S. Efraimidis, Paul G. Spirakis
Weighted random sampling with a reservoir
Information Processing Letters
Volume 97, Issue 5 (16 March 2006)
(Ruby implementation is in [ruby-dev:42844])

An Efficient Method for Generating Discrete Random Variables with General Distributions
ACM Transactions on Mathematical Software, 3 (1977), 253-256.

Matz roughly approved this suggestion. But he said that the method name of "each_sample" and "each_choice" are a bit awkward, and that he want to hear opinions of ruby-core folks.

Of course, we appreciate any comments about the feature itself rather than the name.

--
Yusuke Endoh mame@tsg.ne.jp

#2 - 01/07/2011 09:30 PM - Eregon (Benoit Daloze)

Hi,

On 7 January 2011 12:08, Yusuke ENDOH mame@tsg.ne.jp wrote:

   Hi,

2011/1/7 Yoji Ojima redmine@ruby-lang.org:

   We are planning to add the following features of the random sampling to Array.
   
   1. Weighted random sampling.
   2. Sampling with replacement.
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   It is discussed in ruby-dev (Feature #3647 and #4147).

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There are two reasons why the name "choice" is selected:

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Matz roughly approved this suggestion. But he said that the method name of "each_sample" and "each_choice" are a bit awkward, and that he want to hear opinions of ruby-core folks.
Of course, we appreciate any comments about the feature itself rather than the name.

--
Yusuke Endoh mame@tsq.ne.jp

Thanks for the name clarification.
I think ‘choice’ and ‘each_choice’ are weird.
Sample is "a subset of a population", and so it seems logical to have multiple elements in return.
But choice seems like 'singular', only meant for one element. Is it correct to say "Array#choice returns a choice of some random elements"?
It does not seems right to me.

To this idea, #choice should always return one element, and #sample could be the enumerator (the form which returns an Array would then be Array#sample.take(size)).
However, I guess that would break too much compatibility with current versions.
And I really like 1.9.2 name of #sample for 'a single random element' (even if it might be incorrect to statistics).

Did you consider having another option to [each_]sample to allow replacement?
Such as:
ary.sample 3, replace: true

I see the title of the feature is "Array#sample(n, replace=false)", so I guess the idea was there. How was it decided to instead go for another set of methods?
(Just because of Mathematica's choice? Compatibility seems against users' interest if it is to use a wrong method name)

Or to follow combinations/permutations:
ary.repeated_sample 3

In http://en.wikipedia.org/wiki/Simple_random_sample, the terms used are "simple random sampling with/without replacement", that comfort me to think choice is not the right .. choice (at least for multiple elements).

I am not a native English speaker, so I might be not accurate about this. If this is the case, please ignore what I said.

About the feature, I wonder if an Hash would be a good idea for the weight option.
It can be very similar to a Proc with #default_proc, except much faster for already stored values.

Off-topic:
I think it would be nice if some ruby-dev/ruby-core discussions could be merged.
Even if I cannot currently understand Japanese, I can at least read
their "coded" ideas.
I would see that as using the same topic, with both languages.

#3 - 01/07/2011 10:14 PM - mame (Yusuke Endoh)

=begin

Hi.

2011/1/7 Benoit Daloze eregontp@gmail.com:

Did you consider having another option to {each_,}sample to allow replacement ?
Such as:
ary.sample 3, replace: true

The word "replace" gives impression of modification, for those who
are familiar with programming and not familiar with statistics.
Especially, Ruby provides Array#replace. For example, I imagine the
following behavior:

ary = [1, 2, 3]
p ary.sample(replace: true) #=> 1
p ary #=> [2, 3]

Or to follow combinations/permutations:
ary.repeated_sample 3

Hmm. Is each_repeated_sample OK?

Off-topic:
I think it would be nice if some ruby-dev/ruby-core discussions could be merged.
Even if I cannot currently understand Japanese, I can at least read
their "coded" ideas.
I would see that as using the same topic, with both languages.

Interesting :-)

--

Yusuke Endoh mame@tsg.ne.jp

=end

#4 - 01/07/2011 11:59 PM - Eregon (Benoit Daloze)

=begin

On 7 January 2011 14:14, Yusuke ENDOH mame@tsg.ne.jp wrote:

2011/1/7 Benoit Daloze eregontp@gmail.com:

Did you consider having another option to {each_,}sample to allow replacement ?
Such as:
ary.sample 3, replace: true

The word "replace" gives impression of modification, for those who
are familiar with programming and not familiar with statistics.
Especially, Ruby provides Array#replace. For example, I imagine the
following behavior:

ary = [1, 2, 3]
p ary.sample(replace: true) #=> 1
p ary #=> [2, 3]

You are right, it is misleading.
Maybe, (I thought originally to that, but I changed seeing your answer
in [ruby-dev:42811])
ary.sample(n, replacement: true)
is clearer?

Or, to be concise and explicit:
ary.sample(n, repeat: true)

03/12/2022 4/8
I like this one, what do you think?

Boolean flags in a Hash are not so cool though. But just a Symbol flag (sample(n, :repeat, opts)) would complicate too much the method signature. And I think it is still better than having 2 methods.

Or to follow combinations/permutations:

```ruby
ary.repeated_sample 3
```

Hmm. Is each_repeated_sample OK?

I think it is not too bad, but 'repeated_sample' give me the impression there are a few samples, while it is a single one with replacement.

Off-topic:
I think it would be nice if some ruby-dev/ruby-core discussions could be merged. Even if I cannot currently understand Japanese, I can at least read their "coded" ideas. I would see that as using the same topic, with both languages.

Interesting :-)
On 7 January 2011 18:14, Aaron Patterson aaron@tenderlovemaking.com wrote:

    Why not provide "samples" that returns an Enumerator? Then you could say:
    
    list.samples.each { |x| .... }
    list.samples.map { |x| .... }
    
    etc.
    
    --
    Aaron Patterson
    http://tenderlovemaking.com/

I thought to that too (like String#lines), but as I said upper, a sample is already supposed to be a set of random elements. And so, you are iterating on random elements, of a growing sample. Or you could see that as creating a new sample by adding one element to the old sample. That would make sense.

Anyway, we already have Array#sample returning a single element, so Array#samples seems logical. I prefer it to Array#each_sample too.

About returning an Enumerator, you could also yield like #each if a block is given (again, like String#lines).

Is there a reason to change Array#sample instead of using the enumerator form with take(n) to get an Array of n random elements? Is it so much more efficient?

I find weird to have a method (#sample) returning a single element or an Array depending on parameters.

So here is my proposition:
Array#sample remains unchanged.
Array#samples is like the proposed #each_sample, with the option :repeat to use replacement.

---

Hi,

2011/1/8 Benoit Daloze eregonpx@gmail.com:

    Is there a reason to change Array#sample instead of using the enumerator form with take(n) to get an Array of n random elements?

I find weird to have a method (#sample) returning a single element or an Array depending on parameters.

You have a misunderstanding. Array#sample already supports optional argument to specify the count of elements sampled. This is not a new behavior.

    $ ruby -ve 'p [1, 2, 3].sample(2)'
    ruby 1.9.2p0 (2010-08-18 revision 29036) [i686-linux]
    [2, 1]

Unfortunately, this behavior is included in 1.9.2 which is already released. It can no longer change.

    So here is my proposition:
    Array#sample remains unchanged.
    Array#samples is like the proposed #each_sample, with the option :repeat to use replacement.
Though I'm not against your proposition, it may be a bit confusing because Array#sample may also return some elements.

Also, does anyone have an opinion about the keyword :repeat which allows duplicated samples? Personally, I don't hate.

p [1, 2, 3].sample(5, repeat: true) #=> [2, 2, 3, 1, 3]

--
Yusuke Endoh mame@tsg.ne.jp

=end

#8 - 01/12/2011 03:14 AM - Eregon (Benoit Daloze)

=begin
On 11 January 2011 14:39, Yusuke ENDOH mame@tsg.ne.jp wrote:

Hi,

2011/1/8 Benoit Daloze eregontp@gmail.com:
You have a misunderstanding. Array#sample already supports optional argument to specify the count of elements sampled. This is not a new behavior.

$ ruby -ve 'p [1, 2, 3].sample(2)'
ruby 1.9.2p0 (2010-08-18 revision 29036) [i686-linux]
[2, 1]

Unfortunately, this behavior is included in 1.9.2 which is already released. It can no longer change.

Sorry about that, I just missed it.
I take notice to look ri whenever I speak of a method on #ruby-core.

So here is my proposition:
Array#sample remains unchanged.
Array#samples is like the proposed #each_sample, with the option :repeat to use replacement.

Though I'm not against your proposition, it may be a bit confusing because Array#sample may also return some elements.

Yes, I did not have that in mind, but I still prefer #samples to #each_sample.

So, this is close to the original proposition, except using "repeat: true" instead of "choice" and renaming #each_sample to #samples.

It might be confusing, but I think the general usage with chaining enumerators will be nicer:
ary.samples.map { ... }
vs
ary.each_sample.map { ... }

I do not like using #each_slice in a chain for this reason.

But if people think it is too confusing, then let #each_sample be.

=end

#9 - 01/14/2011 03:49 PM - gunn (Arthur Gunn)

=begin
Like Benoit said, Array#choice does sound like it would return only one element, I very much like the proposal of:

p [1, 2, 3].sample(5, repeat: true) #=> [2, 2, 3, 1, 3]

I don't think the distinction between #sample and #samples is obvious enough, the naming suggests #sample would return one element, and #samples many, not that the latter is an iterator.

#each_sample is a little ugly, but much more self-explanatory I think.
How important is it to have something like `#each_sample` though? Personally, I would probably always do something like this:

```
[1, 2, 3, 4, 5].sample(3).each { |n| puts n }
```

#10 - 03/25/2012 02:18 PM - mame (Yusuke Endoh)
- Description updated
- Status changed from Open to Assigned
- Assignee set to mame (Yusuke Endoh)

#11 - 03/25/2012 10:03 PM - trans (Thomas Sawyer)
Whatever happened to `#pick` and `#pick!` which picked one random element? The term `#sample` strongly suggests the return of a subset.

Another consideration, maybe it would be more useful to use a random delegator.

```
enum.random.sample
enum.random.subset
enum.random.element
enum.random.permutations
...```

There can be many more random functions.

#12 - 11/20/2012 02:31 AM - mame (Yusuke Endoh)
- Target version set to 2.6

My apologies, I forgot this ticket completely. I should have wrapped up this discussion. This missed the deadline of 2.0.0. I'm setting this to next minor. Sorry.

--
Yusuke Endoh mame@tsg.ne.jp

#13 - 12/25/2017 06:14 PM - naruse (Yui NARUSE)
- Target version deleted (2.6)