

Re: Random numbers

Source: <http://sci.tech-archive.net/Archive/sci.math/2007-12/msg04715.html>

- *From:* quasi <quasi@xxxxxxxx>
 - *Date:* Mon, 24 Dec 2007 02:14:15 -0500
-

On Sun, 23 Dec 2007 22:32:06 -0800 (PST), no comment
<adler.math@xxxxxxxx> wrote:

On Dec 23, 9:32 pm, quasi <qu...@xxxxxxxx> wrote:

On Mon, 24 Dec 2007 00:10:57 -0500, quasi <qu...@xxxxxxxx> wrote:

On Sun, 23 Dec 2007 19:46:21 -0800 (PST), bill
<b92...@xxxxxxxx>
wrote:

On Dec 22, 5:25 pm, quasi
<qu...@xxxxxxxx> wrote:

On Sat, 22 Dec 2007
16:30:20 -0800 (PST), bill
<b92...@xxxxxxxx>
wrote:

On Dec 22,
10:16 am,
quasi
<qu...@xxxxxxxx>
wrote:

On
Fri,
21
Dec
2007
10:57:00
-0800
(PST),
simple.pop...@xxxxxxxx

Re: Random numbers

wrote:

On
Dec
21,
11:37
pm,
bill
<b92...@xxxxxxxxxx>
wrote:

On
Dec
21,
3:16
am,
John
<iamach...@xxxxxxxxxx>
wrote:

Given
a
function
that
returns
a
random
number
between
1-5,
write
one
that
returns
a
random
number
between
1-7
for
the
case
when
it
should
be
integer

Re: Random numbers

and
for
the
case
it
can
be
real.

Let
S
be
the
function
that
generates
a
RN
between
1
and
5.
Then

T
=
S_1
+
S_2
+
...
+
S_7

For
the
reals
,
RN_7
=
T/7

Re: Random numbers

May
be
this
should
fix
it:

For
the
reals
,
 RN_7
=
1
+
 $(T-7)*3/14$

Yes,
that
fixes
the
range.

But
it's
still
biased
(that
is,
not
a
uniform
distribution).

quasi

The OP
does not
specify a
uniform
distribution,

Re: Random numbers

merely the
range.

This has already been
discussed.

The obvious assumption
implicit in the problem,
even if not unstated
is that the resulting
distribution should be
uniform. Of course, it
should have been specified,
but common sense dictates
that in the
absence of the required info,
to choose the natural
default.

If there was no preference
for a distribution, there
would be no need
to use the RNG provided for
the range 1 to 5. We could
just always
produce the number 3, for
example. In other words, the
very fact that
an RNG for the range 1 to 5
was given as part of the
problem makes it
clear that the for the actual
problem (not the OP's
deficient
statement of it), it almost
certainly _was_ specified
that the
required distribution should
be uniform.

$RN_7 = T/7$
satisfies the
range 1 thru

Re: Random numbers

7.

So what? It's badly biased.
Worse, since there is no
discussion of
bias or the lack of it, it's
misleading to those unaware
of the issue.

$T/7$ is a
numner in
the range 1
thru 7,
but is it
random?

Ok, but note that $T/7$ never
exceeds 5.

It's definitely not uniformly
random.

If $RN_7 = T$
 $\text{mod } 7 + 1$,
the
probability
of a correct
guess is $1/7$

Nonsense. Do a simulation.

Ok, for the above, I must apologize. For the `_integer_` case,
the
calculation $(T \text{ mod } 7) + 1$ does appear to give a uniform
distribution

Re: Random numbers

Hehe --- I take back part of my apology. It is biased, but only slightly.

The probabilities for $y = (T \bmod 7) + 1$ are as follows:

$$P(y=1) = .1430656$$

$$P(y=2) = .1430016$$

$$P(y=3) = .1428224$$

$$P(y=4) = .1426432$$

$$P(y=5) = .1426432$$

$$P(y=6) = .1428224$$

$$P(y=7) = .1430016$$

The above probabilities are exact, hence you can see a slight bias. Of course, while I had originally intuited a bias, I expected it to be badly biased. I was wrong about that. Only the continuous case is badly biased.

quasi

As to the bias, I had pointed it out quite a while ago. Any random variable which is a function of a fixed number n of independent random variables, each say uniformly distributed on the integers from 1 to 5, CANNOT be uniformly distributed on the integers from 1 to 7, for the very simple reason that 7 does not divide 5^n .

Right, I see that.

Actually, I just posted a problem relating to this issue (I had not yet read this reply).

quasi

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