Re: Randomness

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- *From*: "Matt Zellman" <matt.zellman@xxxxxxxxx>
- *Date*: 2 Sep 2006 23:15:17 −0700

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mensanator@xxxxxxxxxxx wrote:

> Matt Zellman wrote:
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>> Matthias Klaey wrote:
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>>> "Matt Zellman" <matt.zellman@xxxxxxxxx> wrote:
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>>>> mensanator@xxxxxxxxxxx wrote:
>>>>
>>>>> Matt Zellman wrote:
>>>>>
>>>>>> are the
>>>>>> following
>>>>>> string of
>>>>>> digits
>>>>>> random?
>>>>>
>>>>> Not likely.
>>>>
>>>> I suppose that was kind of a stupid question.
>>>> Are they random by some
>>>> definition of random? and if so, what
>>>> definition?
>>>>
>>>>>> 01010000000000000000000000000000100001001000000001100010
>>>>>>
>>>>>> 00001101101111100010101000100111001100110110110110011001
>>>>>>
>>>>>> 11011100111011110100000011010111000001111011111111010001

000000000000000000000000100000000010000000001000000000

101011010011101001101010001001100110001001101001000110011

1010100111110000101011011110100010000100001010010100100000

here's a
better
question.
Could the
preceding
six strings
of digits
conceivably
be
randomly
generated?

Sure.

This question somehow reminds me of a theorem that I heard of, but
never actually seen: "For any given set of data there is a test such
that the data will pass the test" (or converse, "such that the data
will fail the test/such that the null hypothesis is rejected")
I believe it is attributed to Kolmogorov.
Does anyone know something more precise about this?

And Matt, by this theorem the answer to your firts question is "yes".
For the second: I have no idea. The best reference I can give you is
D.E.Knuth, The Art of Computer Programming, Volume 2, Chapter 3, Third
Edition, Addison−Wesley 1998, ISBN 0−201−89684−2. There you may learn
more about random sequences than you ever wanted to know :)

Greetings, Matthias Kläy

Thanks. The way the strings were generated is as follows:

I started with the first however many digits of pi (a number whose digits are provably normal

They are?

my mistake. I mistook the well−evidenced conjecture for a proof. In any case, the first 6 billion digits or so are normal, so it shouldn't make too big a difference for our sample here.

), and applied a series of tests to it:

Oh, a series of tests.

I feel like the guy with the spitoon, I thought it was all one string.

the first sequence gives a 1 for every digit that is a 0 or 1

So eight out of every 10 digits will give 0. How is that random? Any tests that doesn't produce the same number of 1's and 0's certainly isn't going to be random. Even if it does, it will still depend on how they are distributed.

Your coin is definitely biased.

How is it not random? Just because you get more of one outcome doesn't make it not random, it just makes it not fair.

A weighted die isn't nonrandom, just unfair.

the second sequence gives a 1 for every digit greater than or equal to 5

So half will be 1's and half will be 0's. It still won't be random, but it'll be harder to show that.

I think this one will actually be random (and fair).

the third sequence gives a 1 for every digit that is odd

> > Again, same number of 1's as 0's.
>
> > > the fourth sequence gives a 1 for every digit that is the same as the previous digit
>
> > So you'll get too many 0's. Not random.
>
> > > the fifth sequence gives a 1 for every digit that is greater than the previous digit
>
> > Tie goes to 0, so you'll have too many 0's. Also note that under this rule, you can't have more than 9 consecutive 1's. This will be an obvious giveaway of non−randomness when you make the sequence big enough since, in a random distribution, all sequence lengths occur eventually.

the max run of 9 does make for an interesting restriction...

> > > the sixth sequence gives a 1 for every digit that is a 3,4,5, or 6
>
> > Again, simply too many 0's. Obviously non−random.
>
> > > The resulting sequences are not (necessarily) normal, but I think they can still be described as "random" as long as there is some nonzero chance that a digit could be either a zero or a one.
>
> > But you have to say up front what the probabilities are if they aren't 1/2. So, no, the sequences with differing 1 and 0 counts can't be described as random. And the fifth sequence can't be described as random even if you give the probabilities.

I don't know... I remember all my statistics textbooks explicitly designating a coin or die as fair in order to establish the normality of the distribution. Why would that be necessary if the concept of randomness necessarily included normality?

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