

Re: real world birthday problem.

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*Source:* <http://sci.tech-archive.net/Archive/sci.math/2005-11/msg01997.html>

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- *From:* quasi <quasi@xxxxxxxx>
  - *Date:* Tue, 15 Nov 2005 21:31:32 -0500
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On Tue, 15 Nov 2005 20:45:22 -0500, quasi <quasi@xxxxxxxx> wrote:

>On 15 Nov 2005 16:27:57 -0800, "mensanator@xxxxxxxxxxxxx"  
><mensanator@xxxxxxxx> wrote:  
>  
>>  
>>pauldepstein@xxxxxxx wrote:  
>>> If I remember rightly, you can use basic probability theory to argue  
>>> that you need 23 people in a room to get a probability of  $\geq 50\%$  that a  
>>> pair in the room share a birthday.  
>>>  
>>> However, has this empirically been tested?  
>>>  
>>> Here is my guess as to what actually happens, but I think it would be a  
>>> worthwhile topic for research if no one has actually done so.  
>>>  
>>> As I understand it, there is no correlation between time of year and  
>>> birth rate in the U.S. or in England. (This is rather  
>>> counter-intuitive to me because I would have expected more sexual  
>>> encounters around New Year's Day and Valentine's Day, and I would  
>>> expect levels of sexual arousal to be higher generally during the  
>>> summer, and for this to be reflected in birthdays; but I think there is  
>>> actually an even spread.)  
>>  
>>You think? Not very scientific.  
>  
>He says "I think" presumably because he's not sure.  
>  
>He's not doing any experiments -- it's just a topic for discussion --  
>so he doesn't need to be scientific.  
>  
>>>  
>>> However, since babies are not induced on weekends, births peak on  
>>> Mondays and are rarer on weekends.  
>>>  
>>> So, if the birthday question is posed to a crowd of mixed ages, the  
>>> mathematical model and the real-world model should fit fairly closely  
>>> since no date is more suggestive of a weekend birth than any other.  
>>>

Re: real world birthday problem.

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>>> However, if the question is posed to a cohort with a gap of less than a  
>>> year between oldest and youngest (as in a high-school class), then the  
>>> weekend factor would be huge. Hence the actual same-birthday  
>>> probability would be much greater than the conventional calculations  
>>> indicate.

>>  
>> Calculations based on the assumption of fair distribution.

>  
> As he's pointing out, that assumption may be too far off from reality  
> to be usable in the real world.

>  
>> so Why does it surprise you that you get the wrong answer when your assumptions  
>> are wrong?

>  
> I don't think it surprises him.

>  
> In fact, he's specifying some situations where he expects the  
> predicted answer to show a consistent bias versus actual data.

>  
>>>  
>>> So what looks like an impressive application of pure maths to examine a  
>>> real-world situation is a completely bogus one leading to wildly wrong  
>>> probabilities.

>>  
>> Wildly wrong? How wildly wrong? Does the weekend adjustment result  
>> in a whole person, i.e., do you actually need 24 to find a duplicate?

>  
> Well, there's the math problem. How wrong does it have to be before  
> the adjustment is noticeable?

>  
> By the way, 24 is going wrong the way. The bias would tend to make the  
> answer less than the predicted number, not more.

>  
>>> Ironically, the inaccurate nature of this experiment  
>>> might lead teachers to be drawn to such class demonstrations since the  
>>> weekend factor leads to the desired result more often than expected.  
>>> (Desired because students are generally pleased to find the matching  
>>> pair.)

>>  
>> When the teacher queries the 30 students in the class and finds a  
>> duplicate, he says "See, I was right."

>>  
>> When he queries the 30 students in the class and finds no  
>> duplicate, he says "See, I was right."

>>  
>> I don't see any problem here.

>  
> That depends how far off the actual data is from the prediction. If  
> it's too far off, and consistently so, that calls for an explanation  
> (such as the one he suggested), and possibly a new model.

>

Re: real world birthday problem.

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>But again, as in your earlier error, 30 is going the wrong way.  
>  
>>> This is very conjectural, since I haven't seen any real-world analysis  
>>> of the birthday question.  
>>  
>>Because nobody cares.  
>  
>It seems interesting to me.  
>  
>>>  
>>> Any comments?  
>>  
>>Yeah, why don't you get a grant and build a machine to study coin  
>>flipping.  
>  
>Forget real-world experiments -- there are some interesting math  
>problems hiding here.  
>  
>quasi

Ok, I just did a quick simulation.

Assumptions for the simulation:

- (1) The group of people for the experiment are all born in the same year.
- (2) The birth year for the group is a 365 day year, starting and ending on a Monday.
- (3) All days of the week are equally likely except that any births which normally would normally have been Saturday and Sunday are deferred until Monday. Thus, the days Monday through Sunday have the probabilities  $3/7$ ,  $1/7$ ,  $1/7$ ,  $1/7$ ,  $1/7$ ,  $0$ ,  $0$ , respectively.

Using these assumptions, the simulation reveals that with probability  $1/2$ , it will take no more than 18 people to get a duplicate.

quasi

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• **References:**

- ◆ **real world birthday problem.**  
◇ From: pauldepstein
- ◆ **Re: real world birthday problem.**  
◇ From: mensanator@xxxxxxxxxxxx
- ◆ **Re: real world birthday problem.**  
◇ From: quasi

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- Prev by Date: *Re: Given the Taylor's Polynomial, can you generate the function?*
- Next by Date: *Re: Zermelo–Fraenkel Theory Of Sets*
- Previous by thread: *Re: real world birthday problem.*
- Next by thread: *Re: real world birthday problem.*
- Index(es):
  - ◆ *Date*
  - ◆ *Thread*