Approach the truth

About the calculation of leap years

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Title: Unraveling the Truth About Leap Years

Abstract: This report delves into the intricacies of leap year calculations, exploring the historical and astronomical reasons behind their implementation in our calendar system. It examines the stories behind the "disappearance" of ten days and the peculiar naming of the October Revolution, leading to an in-depth analysis of the rules governing leap years and the ongoing efforts to minimize calendrical inaccuracies.

Introduction: The concept of a leap year is deeply rooted in our calendar system, designed to account for the discrepancies between the Earth's orbit around the Sun and our standard 365-day year. This report, titled "Unraveling the Truth About Leap Years," authored by Guo Zhengyue from Class 6(1) in May 2018, presents a comprehensive examination of why leap years are necessary and how their rules have evolved over time.

The Curious Case of Missing Days: Two historical anomalies prompt the question of leap year calculations. The first is the "October Revolution," which occurred on November 7, 1917, yet is named for the month following the Julian calendar, which was in use in Russia at the time. The second is the non-existence of ten days in October 1582, when these days were skipped to align the calendar with the solar year.

The Necessity of Leap Years: The Earth completes an orbit around the Sun in approximately 365.242199 days. This fraction, when multiplied by four, results in nearly a full day, hence the establishment of a leap year every four years. However, this approximation leads to a small but significant deviation that accumulates over time.

Leap Year Rules and Their Evolution:

1. **Rule ①:** A year is a leap year if it is divisible by 4, such as the years 4, 2016, and 2020.
2. **Rule ②:** However, if a year is divisible by 100, it is not a leap year, unless...
3. **Rule ③:** The year is also divisible by 400, in which case it is a leap year, as seen with the years 400, 2000, and 2400.

These rules address the discrepancy of approximately 0.031204 days, or 44.9 minutes, that accumulates every four years. Over a century, this results in an excess of nearly 18.7 hours, necessitating the removal of a leap year every 100 years. However, this adjustment still results in a slight error, leading to the addition of a leap year every 400 years to correct for the undercompensation.

Conclusion: Despite our best efforts, there will always be some margin of error between the Earth's orbital period and our calendar days. The leap year system is a sophisticated calculation designed to minimize this error and bridge the gap between the two. While we can never achieve absolute precision, we can continue to refine our methods to approach the truth more closely.

Reflections: The inevitability of errors and the pursuit of relative accuracy are central themes of this report. It is crucial to be mindful of the cumulative effect of small errors, as they can significantly impact calculations. While we strive to reduce these errors through precise algorithms, perfect elimination may be unattainable. Careful numerical computation is essential, as mistakes can have cascading effects on overall outcomes.

References:

- Historical accounts of calendar reforms
- Astronomical data on Earth's orbit and solar year duration
- Mathematical explanations of leap year calculations

逼近真相

关于闰年的计算

六(1)班 郭正悦
2018年5月

2个故事带来的问题

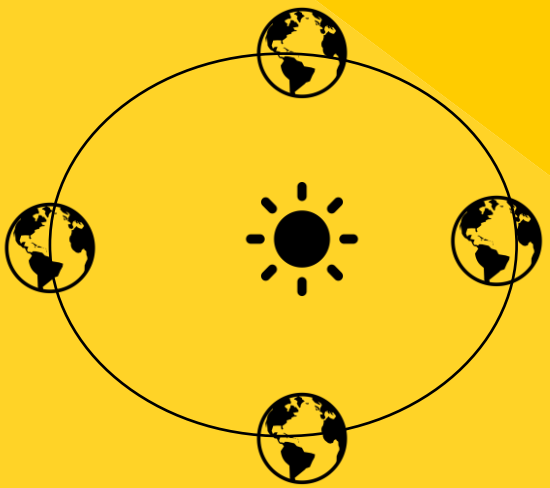
十月革命

? 发生在1917年11月7日这次划时代的革命为何被称为“十月”革命?

消失的十天

? 公元1582年10月5日到10月14日这十天在人类历史上并不存在?

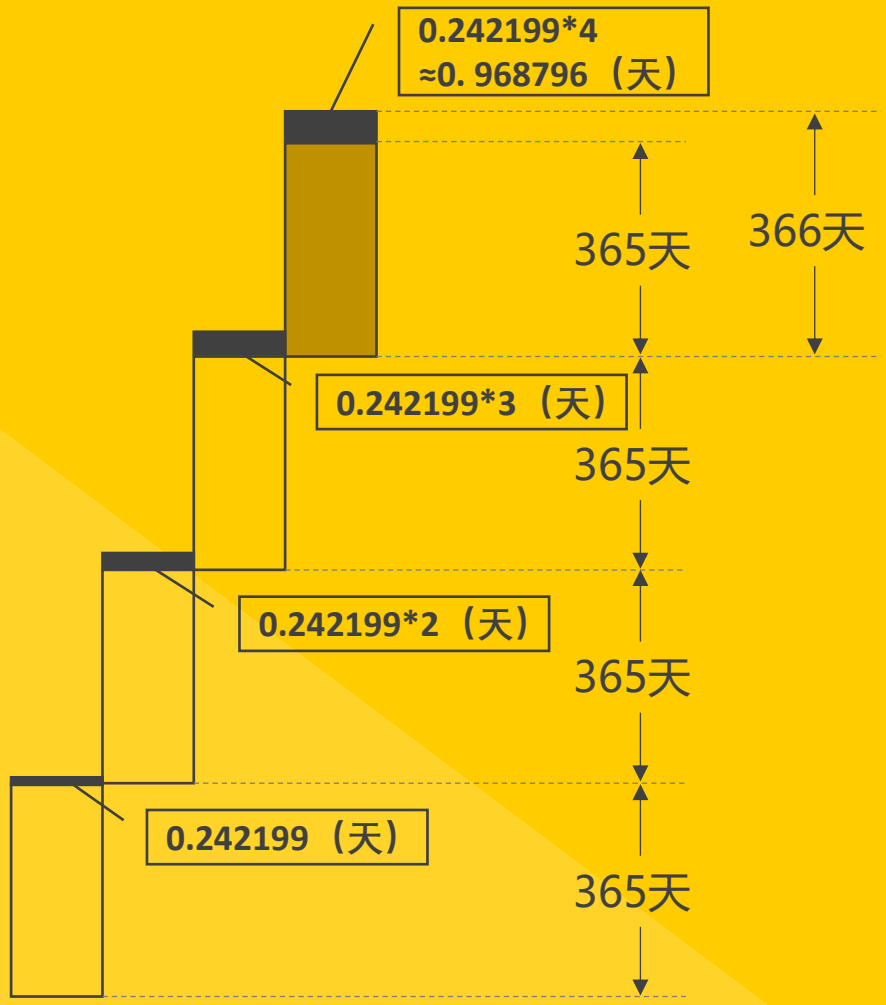
为什么每4年设一闰年?



地球绕太阳一圈

365天5小时48分46秒

≈365.242199天



闰年规则①：年份数能被4整除，则为闰年，如公元4年、2016年、2020年

难道公元100年不是闰年？

100年日历日
=365*100+1*(100/4)
=**36525**(天)

每4年按立法算
还多了
1-0.968796
=0.031204(天)
=44.9(分钟)

地球绕太阳转100圈（100回归年）
=365.242199*100
≈**36524.219907**(天)

小小的偏差积累100年就多了整整0.780093天
（约18.7个小时）
所以每100年要去掉一个闰年！

闰年规则②：年份数虽能被4整除，但也能被100整除的则不是闰年

如公元100年、1900年、2100年

2000年，欢迎归队！

小小的偏差积累100年就多了整整0.780093天（约18.7个小时）**所以每100年要去掉一个闰年！**

还有1-0.780093天的误差

每100年少算了0.219907天

每400年少算了约0.88天(21小时多)

这样又会产生近1天的误差。因此，每400年再多加一个闰年，是十分必要的！

闰年规则③：年份数虽能被4整除，也能被100整除，但同时还能被400整除的，则仍算作闰年如公元400年、2000年、2400年

还有误差怎么办？继续修正！

每400年还是会有约0.12天的误差，怎么办呢？

误差总会存在，真相可以逼近！

结论

不论如何设置闰年，公转的天数和日历天数都是会有误差，我们的计算是在让误差变得越来越小，来弥补这些时间差。闰年是一个精密的计算系统。

心得

误差不可避免，无法求得绝对精确值，有些事不必追求最后精准的答案

误差的积累可能会对计算结果产生极大影响，必须要加以注意

数字计算必须要仔细不然容易出错，一旦出错，会影响整体

误差可以通过精确的算法设定加以减小，但可能无法完全消除

谢谢大家！

六(1)班 郭正悦