Time Series L6 Copymaster

Comments and answers to questions on the data sets

1. Olympic Games Data

2. 1968 1988

The Olympic Games take place every four years these were not two of them.

These were war years; during WWII the Olympics did not take place.

The race was measured to the nearest tenth of a second in 1948 but to the nearest hundredth in 1952. Improved technology made this possible.

1988

There were other events during 1968 besides the Olympic Games where athletes could have jumped higher.

3.

4. No.

Random fluctuations occur due to, among other things, different track and weather conditions, the fact that different athletes are taking part, that they perform differently each time out and so on.

5. Yes, although from Olympics to Olympics we cannot predict a decrease in time for the 100m, there is a general trend downwards and over ten Olympics (40 years) there is likely to be a reduction.

Improved results are due to things like better track conditions, better running gear (shoes etc.), improved diet and fitness training, and so on.

They will most likely keep declining but by smaller amounts. These results will ultimately become too small to measure. (Unless there is some dramatic change something such as diet or a jumping technique.)

The start is already electronically coupled with the start gun and the finish photographed. If it is possible to time more accurately then smaller increments can be measured and hence faster times recorded. The graphs will edge downwards just that little bit more towards a lower limit.

There is a lower limit for which athletes can run the 100m. After all no-one could run it in zero seconds. What that limit is though no-one can be certain. That won't stop students having firm ideas on the subject giving the opportunity for much animated discussion.

6. Yes.

Better training, better gear, better conditions and so on.

For a while but since the high jump at the moment is measured to the nearest centimetre it may take some years before each increment is improved upon.

High jumps are measured to the nearest centimetre.

Perhaps sometime the high jump may be measured to the nearest millimetre but further restrictions will need to be made on the number of jumps an athlete may make.

There will be an upper limit but what - who knows. This will provide material for endless discussion among students.

7. The data does not support the contention that men and women will be able to compete alongside each other in the same athletic events, at least, not in the foreseeable future.

2. Life Expectancy

2. 60 years

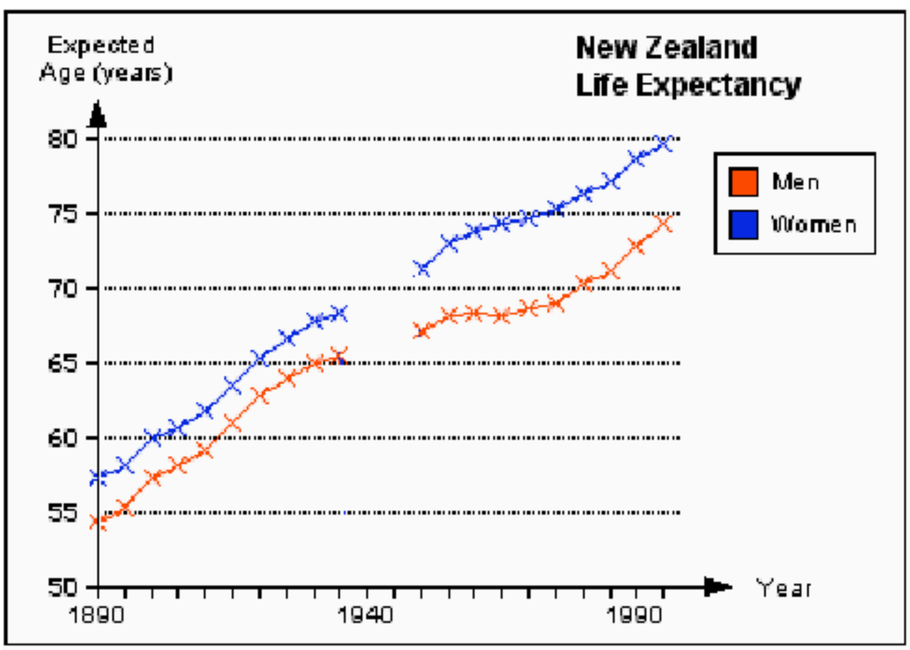
Yes, for women between 1950 and 1960. There may also be a decrease for the years 1940 and 1945 but we have no data.

These were war years when people had other things on their minds than work out life expectancy. Data may have been difficult to collect or with war casualties and other factors there may have been reasons why they were not collected.

The difference between men and women's life expectancy increased

The difference in life expectancy between men and women was six years in 1970, 1980 and 1985.

3. Over the ten years 1890 to 1900 life expectancy for women increased three years, an annual rate of about 110 days per year. For the ten years from 1985 to 1995 the increase was 3.2 years over the ten or 117 days per year.



Poor sanitation and post-natal care.

Improved healthcare, better nutrition, better sanitation, greater personal independence leading to an increased awareness of the value of life.

Both life expectancies are steadily increasing with apparently no upper limit. This is, of course, impossible. One would expect the improved healthcare and other factors to radically decrease the number deaths in children (which it has) and this in turn to cause the increase in life expectancy to level off (it hasn't!) after the benefits of keeping young people alive had pushed up the average lifespan. The current trend cannot continue without some dramatic change.

The rate has not slowed. Why? Are we beginning to change the nature of old age? What is causing this increase and how long will it continue? There's plenty of room for student discussion here.

3. Predator-Prey

3. 20,000

The fourth year.

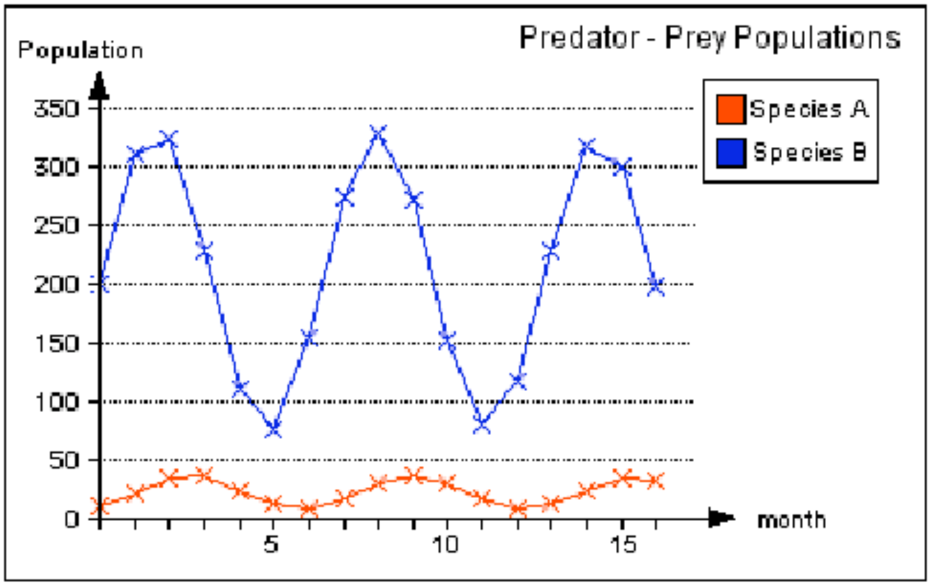
One year.

On the graph of the given data (or from the table) it is seen that the peaks and troughs in the population numbers for species B lie slightly ahead of those for species A. This suggests that species A is the predator. What happens is that species B's population numbers rise due to low predator numbers. Predator numbers in turn rise in response to the increase in prey until their numbers reach a figure which the prey cannot sustain. The prey population then diminishes. Without large numbers of prey to feed on the population of predators decreases in turn. The cycle then repeats since with few predators the prey numbers can again increase.

With unlimited food and no predators the population number of a species might perhaps, at first, increase. There are however assumptions here. If there had never been any predators it would not be in the best interest of the species to increase in numbers. The larger population would be competing for the same amount of food. Even if the food supply was guaranteed there would still be pressures of competition due to reduced space and hence increased likelihood of disease and so on.

Factors which effect population numbers include availability of breeding space, health factors, predator numbers, food supply, water supply, shelter from weather extremes and many others.

Unlimited predation on a species is likely to reduce the population so much that food becomes scarce for the predator. That in turn reduces its population.



The lemmings' population numbers cycle every four years as do those of their principle predator the stoat. However, peak numbers of stoats follow approximately one year behind those of the lemmings. Hare numbers in Canada and those of the lynx, its principle predator, cycle about every 10 years.

The given data cycles approximately every six years.

Cicadas provide an interesting example regarding population cycles. Although they appear each year major population irruptions occur less often. The life cycle of one US species takes 13 years, another is 17. One species outside the US takes 11 years. The life cycle of New Zealand 's highland cicada is five years and that of the lowland species seven. It seems the small populations that occur between the main irruptions provide a fail-safe mechanism should the main population be wiped out. What is interesting is the timing of these cycles. Why these number of years and not 6, 8, 12, 15 or 18, for example. A partial explanation has to do with the life cycles of most of the cicadas' predators which range from 2 and 4 years. If the cicadas' life cycle was every six years it would be hit just about every year by its predators. That major irruptions cycle in a prime number of years minimises the occasions when high numbers of predator and prey coincide. Interestingly, major irruptions of the New Zealand highland weta occur every 11 years while that of its major predator is 19 years.

4. Students could come up with a wide selection of time series data that cycle, these might include: young peoples' spending patterns which seem to rise at the weekend, sales of seasonal items such as camping gear, road traffic volume which rises during the rush hour, sunspot activity and school absenteeism which rises towards the weekend. There are peak times that people travel and when pets are active. The hours of daylight throughout the year cycle as do tides.

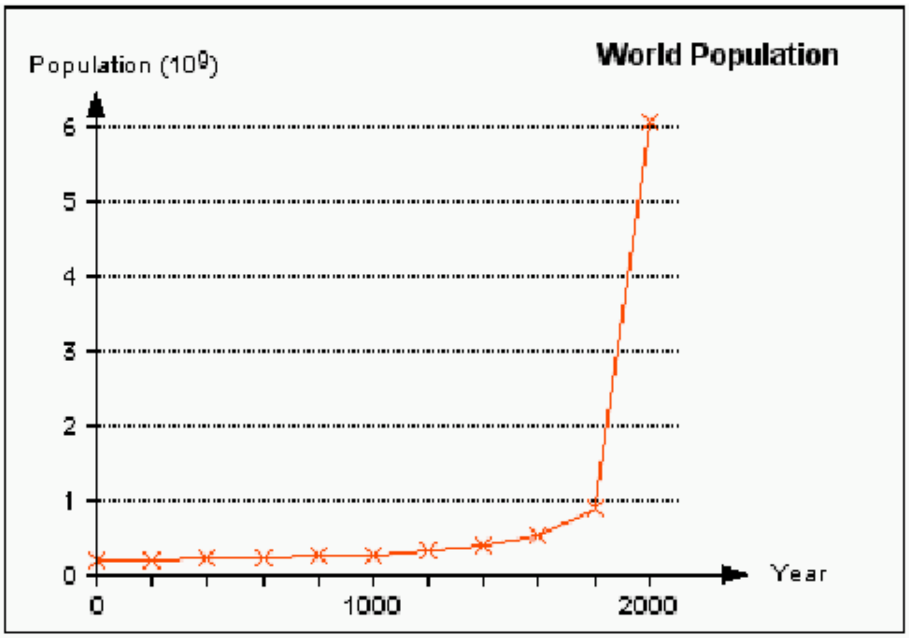
World Population

240 million.

In 2000, the world had 6.1 billion human inhabitants. For the last 50 years, world population has multiplied more rapidly than ever before, and more rapidly than it will probably ever grow in the future. Anthropologists believe the human species dates back at least 3 million years. For most of our history these distant ancestors lived a precarious existence as hunters and gatherers. This way of life kept their total numbers small, probably less than 10 million. However, as agriculture was introduced, communities evolved that could support more people. World population expanded to about 200 million by the year 1 CE and continued to grow at a moderate rate. After the start of the Industrial Revolution in the 18th century, living standards rose and widespread famines and epidemics diminished in some regions. Population growth accelerated.

In 1800, the vast majority of the world's population (86 percent) resided in Asia and Europe, with 65 percent in Asia alone. World population growth accelerated after World War II, when the population of less developed countries began to increase dramatically. After millions of years of extremely slow growth, the human population grew explosively.

A graph of Table 1 shows quite uncompromisingly this state of affairs. However, we know that this rapid increase cannot continue indefinitely.

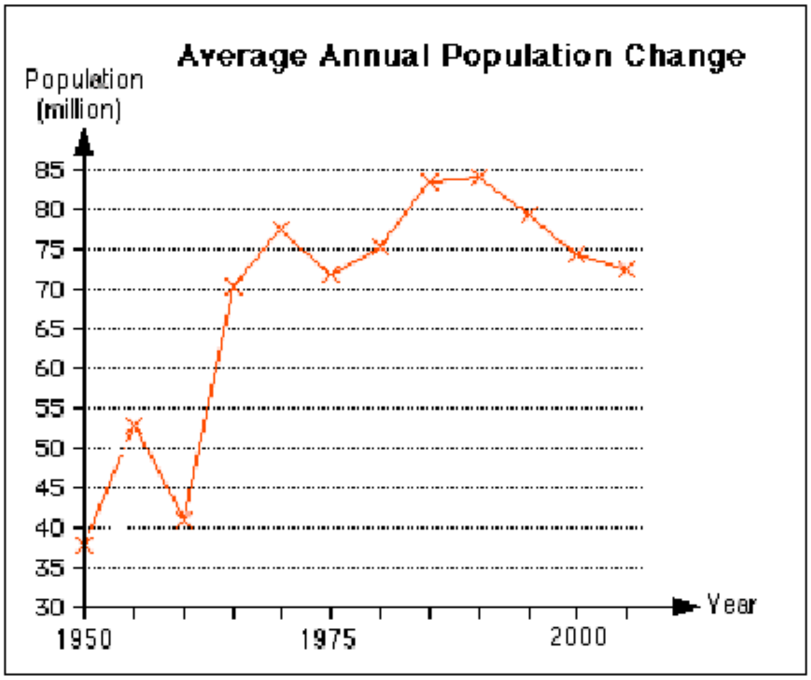


A graph of Table 2 gives a different picture.

Looking at the graph of population from 1950, although the population steadily increases over the 55 years there seems to be a slight slowing between 2000 and 2005. The graph of the average annual growth rate reinforces this.

5.Although extrapolation can be dangerous, students are asked to predict population figures for the years 2025 and 2050. The key figure is that of the average annual growth rate. From its graph it appears to be less volatile than the population and a figure can therefore be estimated with some confidence at probably just over one per cent per year.

Alternatively,students might look at a graph of the average annual population change. This again, though, looks fairly volatile and less likely to give good predictive values.



It is less important for students to predict population figures in line with more authoritative sources than it is that, whatever their prediction, it is consistent with their arguments.

The United Nations predicts the World population in 2025 and 2050 to be 7.934 and 9.276 billion respectively.