# CFB 3333 Assumptions

## The Nature of Assumptions

In short, an assumption is something you take as true even though you lack good evidence for it. Scientifically, you only have to **assume** things that you do not **know**. For example, it is not necessary to assume the value of the Astronomical Unit (radius of Earth's orbit), the speed of light, that air contains about 20% oxygen, or that many diseases are caused by bacteria; these things are **known**.

You might want to break assumptions down into categories:

- **Educated assumption**: The assumption is made from a base of knowledge about the situation. Given all available knowledge, the assumption will appear to be reasonable. It is possible that the assumption will turn out to be reasonably close to the truth.
- **Design assumption**: When designing/engineering something, it is often necessary to make some assumptions about the market, environment, or other properties in order to guide the design process. These assumptions help define the process.
- **Unconscious Assumption**. There are almost certainly some things which you take to be facts that are really assumptions; you couldn't prove them if you had to. These can be insidious, as you don't realize that you are making an assumption.
- **Simplifying**: A reasonable assumption about a problem which makes it easier to analyze.
- **WAG (Wild-Ass Guess)**: Such an assumption is really a wild guess without basis in any knowledge. WAGs can be wildly wrong.

It is VERY important to understand which one of the above you are making at any time.

## Why Make Assumptions?

Keep in mind one simple fact: **It is impossible for you to know everything.**

It is certain that, in life and work, you will encounter things you must deal with but which are not familiar. In these cases, lacking knowledge, you must assume something. It happens all the time and many times you are not conscious of it.

You make assumptions for various reasons:

- So you can live life instead of hiding in a closet.
- To constrain the design of something.
- To allow you to investigate a research question when you don't know everything going in. Assumptions help define the problem.
- Because you **must** assume - you can't know everything.

# Assumption Analysis

Most people are not accustomed to analyzing their assumptions, but doing it could save a lot of misery. Scientists have to detail their assumptions in their scientific papers. Why shouldn't we do something like that?

When planning some action, do the following:

1. Write down *everything* you are assuming. This is not easy and will take a good bit of practice. Write down every numerical value, condition, expected occurrence and so on. When done, look at each one and ask the question "Do I *really know* this? Check carefully. If you find that you do not really know, then you are assuming.
2. Look at each assumption and try to figure out what happens to your results if that assumption turns out to be wrong!
3. If the consequences of a wrong assumption are quite bad, you might benefit from investigating that assumption *very* carefully.

You won't have to look far to find examples of someone getting into trouble because of wrong assumptions.

# What's Going to Happen

It seems that failure to answer this question is part of short-term thinking. What will happen if...? Answering this is hard. It often requires predicting human behavior, which is usually difficult. Also - the person who should be asking the question is often focused on the near term and cannot imagine what might happen in the future or on a larger scale. It's sort of like looking at the world through a paper towel tube; your view is constrained so you don't see everything.

It means, among other things, that you just think you can control the world around you. Any action to accomplish one limited purpose will likely produce effects you didn't expect. Some of these effects can be quite unfavorable, in some cases worse than the original problem.

# An Example

The recent disastrous housing bubble offers a chance to look at a few assumptions that failed.

Consider the apparent fact that median house prices in California tripled in 10 years (1996 through 2006). If you do the math, you find that this is 11.6% annual appreciation. That is a huge rate of appreciation! Once such an appreciation rate gets established, it becomes a mass psychology. Buy a house now and get in on the bonanza before the price goes up again.

What kind of assumptions might be found here? Can you think of any others?

- The 11.6% appreciation rate will continue indefinitely.
- Buyers will continue to appear as the prices rise.

- You can't lose by buying real estate.

Note well: these ARE assumptions. You can't prove any of them, as they all involve future events. The Danish physicist Niels Bohr is credited with saying "Prediction is difficult, especially about the future."

Let's look at the first assumption - the idea that 11% appreciation can go on indefinitely. This is a compound rate of appreciation.

- 1 year: 1.116 times the previous year's value
- 2 years: 1.116 times 1.116 times the first year's value year n: $1.116^n$ times first year's value

Carry this out a bit. What would happen in 20 years? Get a calculator, do the math, and discover that prices should appreciate by a factor of 9 over the 20-year period. What a deal! Buy in now and in 20 years your property will be worth 9 times what you paid for it. If you buy a house now for $300,000, it will be worth $2,700,000 in 20 years.

What's wrong with this picture?

Beneath the first assumption lies another one: Enough buyers will appear to buy houses as prices rise. You are assuming (because you DO NOT KNOW) that an ample supply of people can afford the houses and are eager to buy in.

Let's look critically at this idea. We are looking at exponential growth. A number greater than 1 taken to a positive power greater than one produces this. Following the discussion above, we find that $1.116^{20}=9$. In 30 years we have $1.116^{30}=27$. in 40 years the factor is 81. Over time the factor grows without limit. Here's where the problem lies. The problem is called affordability.

In order for a steady supply of homebuyers to appear, houses must remain affordable. Median incomes must rise at the same 11.6% rate so buyers can afford the mortgage payments as house prices escalate. How might this come about?

1. People's real incomes actually do rise at this rate. This would be a wonderful situation if it happened. You could find out something about this by looking at immediate past income history; if such a rise is occurring you can see it.
2. Incomes (and all prices) rise at this rate because of rampant inflation. This is not so good.

Is the problem becoming apparent? If one had looked at the numbers in California in the 2000 time frame, it would have been clear that inflation was low and incomes were not rising at 11.6%. House affordability would be adversely affected. increasing numbers of people would be priced out of the housing market as prices escalated. The second assumption above, the one about a supply of homebuyers, would be wrong.

Further thinking would allow one to figure out that if the buyer supply drops that the first assumption about 11.6% growth is also wrong, as supply would overtake demand, resulting in price drops. If that happened, then the third assumption above, that you can't lose money in real estate, would also be wrong.

Absent inflation, the only way to keep the price growth going is to keep the buyers coming. History tells us now that this was done by creating a great menagerie of creative mortgage products that featured low monthly payments for several years before resetting to the higher payments required to actually pay off the loans. These were called subprime, adjustable rate and Alt-A loans. A little study of recent history will reveal what happened: the biggest housing bubble crash in well over 150 years.

General lesson here: exponential growth in almost anything you can name is unsustainable in the long term. That's right - unsustainable.

- World population
- World oil production
- Traffic projections
- Real estate prices (absent runaway inflation)
- The price of tulip bulbs (read the history of this)
- ...

Outline