The physicists tell us that quantum effects rule the universe. Every physical event that occurs has a number of alternative outcomes. Whenever the moment arrives for one of these choices, all the possible outcomes occur, and the universe splits into a number of more or less different copies. If there are 2 possible outcomes, the universe splits into 2 copies. 1000 possible outcomes, 1000 copies, each different in some way from all the others.

As far as we are aware, there is only one universe – the one that resulted from all the events that have occurred in what we think of as history. But there is an (effectively) infinite number of other universes that have followed other paths. Ones in which

- Cardinal Wolsey succeeded in organising a pan-European alliance that endured for a thousand years, and ushered in an era of World Peace (contestants in beauty pageants were thus deprived of their most popular answer to the question “If you could achieve one thing to change the world, what would it be?”)
- A meteor narrowly missed the earth 60 million years ago, causing enormous earthquakes that reshaped the continents, without resulting in the extinction of the dinosaurs which, under evolutionary pressure of living in the reshaped landscapes, evolved into a race of intelligent two-legged, two-armed beings with spines down their backs, in a society indistinguishable from ours except that fashions and seating had to allow for the spines.
- I won $25m on Lotto as a result of making a statistically-aware statement that the only way to win at Lotto was never to buy a ticket, causing a friend to buy me a ticket on the sly, which won the largest ever payout to that date, whereupon I retired, but was miserable without the intellectual stimulation of devising undergraduate assignments.
- A compound with a structure only slightly different from chlorophyll’s evolved as an energy-fixing engine in plants. Its light absorption differed slightly from chlorophyll’s, resulting in foliage tinted delicate lilacs, pinks and mauves. Sadly, no-one was aware of this because, in this universe, humanity did not evolve colour vision.

So how does this affect you? Well, you were walking past the Science Towers one day, thinking fondly about digital logic, when the new NMR machine emitted a concentrated high-frequency magnetic pulse. The technician doing the testing noticed that the output was set too high and adjusted it with no ill effects, except that the fabric of space-time was disrupted around a piece of matter that was instantly interchanged with a similarly-shaped piece of matter from another universe. A you-shaped piece of matter. A you-shaped piece of matter that happened to actually be you. Well, all of you except for your eyelashes.

You continued on your way, blissfully unaware, for the moment, of any changes except for a sudden feeling of chilliness around the eyeballs. But there were changes. Oh yes, indeedy. In the universe into which you had been transported, computers had been
invented, but curiously, all had mysteriously caught fire and incinerated not only the
buildings they contained, but also their inventors. Deprived of its motive forces,
development of the computer stalled in 1949 and was only now starting to be considered
again, in a few poorly funded laboratories, mostly run by nutters.

You, therefore, arriving in this world with a head full of computer knowledge and
tales of technologies that can fit a billion transistors on the head of a pin, were widely
mocked and at one point narrowly avoid being incarcerated by men in white coats. (There
are a number of curious anachronisms about this environment. Men in white coats is one.
The blockiness of the buildings, which you at first took to be an optical illusion, but which
you have now realised is caused by the lack of computers to hone the buildings down to the
absolute cheapest minimum is another. And the higher standard of professional
responsibility that results from a society in which it isn’t feasible to measure and record and
regulate everything, so that people are freer to make their own decisions.)

You see a business opportunity. If you can get in at the ground floor on the
development of computers, you could, with your knowledge of modern techniques,
leapfrog fifty years of development and develop machines of unsurpassable power,
becoming, in the process, rich beyond your wildest dreams. But the immediate problem is
to convince people that you really do know something about electronics.

You appear, in this universe, to be enrolled in Mossy University electrical
engineering papers. Discovering this involved an embarrassing trip to the Registry to ask
for the details of your course, which you claimed to have forgotten. But now you’re trying
to gain entry to the postgraduate program without completing a degree. You’ve already
convinced the lecturer – a big forbidding-looking bloke with glasses a beard and absolutely
no sense of humour – that you really do have some electronics nous by designing a counter
and a multiplexor based on the thermionic valve AND, OR and NOT gates that they’ve
recently acquired. That was enough to convince them that you aren’t just a fast talker. Now
they’ve come up with a real challenge to regulate your entry into the postgraduate world.

You’ve been directed to use the ASM technique that you’ve been boasting about, as
the basis of a system that can be used to count the number of people going into and out of
the zoo. You won’t have to actually build the electronics (something of a relief, since you
don’t know anything about thermionic valves); it will be sufficient to produce a design on
paper using conventional digital logic symbols. The zoo has a one-person-wide entry/exit
aisle which incorporates two detectors that use light beams and photodetector cells. Each
light beam shines across the aisle at one of the photodetector cells. The device that houses
the photodetector also contains an inverting amplifier which works so that a break in the light
beam generates a change in the device’s output from a low voltage to a high voltage. The
voltage goes low again when the light path is re-established. The photodetectors are positioned
about two cm apart, so that a body passing down the aisle will break first one beam, then
the other, then re-establish the first beam and then the second. People going in will
therefore generally break beam A, then beam B, then re-establish beam A and then beam B.
Occasionally, someone will change their mind partway through and back out before
completing the sequence. This should be correctly interpreted.

The zoo wishes to keep track of two things – how many people are in the zoo at any
one time, and also how many people have visited the zoo in total.

You don’t need to design the counters, register or multiplexors that will be used in
this system; you can simply specify what you need and get your circuit to produce the
appropriate control signals to make them behave as required.

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