Wetropolis Flood Demonstrator Quiz

Welcome to the ***Wetropolis Quiz*** on extreme rainfall and river flooding! Work together?

Q1: *How long does it (approximately) take for a steel ball to fall through the Galtonboard(s)?*
a) 1 second; **b)** 10 seconds; or **c)** 100 seconds?
That is the length of a day in Wetropolis, a so-called Wetropolis day —with *new SI-unit wd*.

Q2: Notice which two lights light up on the Galton board(s) during a wd (Wetropolis day) and notice what happens in the river set-up with rain falling on the moor and reservoir.

When lights in channels "2 seconds" and "moor" light up, say, what happens in the river set-up?
a) Rain falls for 4s in the reservoir; **b)** there is no rainfall; **c)** rain falls for 2s in the moor.

Q3: There are 4 rain-duration outcomes (that is: 1s,2s,4s or 9s of rainfall per wd) and 4 rain-location outcomes (that is: rainfall in reservoir, in reservoir & moor, in moor or no rain).

What is the most extreme rainfall event possible during one Wetropolis day?
a) No rainfall; **b)** 9s of rain on moor; **c)** 9s of rain in reservoir & moor; **d)** 9s of rain in reservoir.

Locate the city in the set-up. Next observe Wetropolis over several days and notice that the city (only) starts to flood after such an extreme rainfall event. On average you will have to wait for a certain number of Wetropolis days, that is for a return period, for flooding to occur.

Q4: *When an extreme event is seen to occur after a steel ball falls though the Galtonboard(s), what can you do the lessen or prevent the city from flooding?*
a) Hold back water in reservoir by using its lock gates; **b)** nothing; **c)** hold back water in reservoir by using lock gates after *first* (sufficiently slowly, why?) emptying the reservoir during "dry" times.

Q5: During climate change more (annual or Wetropolis) rainfall is predicted. *Find the climate-change rainfall switch; turn it on and observe what happens!*

Q6: The water volume flooding the city is the flood-excess volume (see poster): collect and measure that volume underneath the city by turning the valve off/on under the city (and play!)

The Wetropolis Event Probability (WEP) is thus circa 2.73%, the analog of the Annual Event Probability (AEP) used by the Environment Agency in *flood-risk maps* for your house. The EA uses 1/30=3.3%, 1/100=1% and 1/1000=0.1% flood-risk thresholds -see https://check-long-term-flood-risk.service.gov.uk/postcode [Type in your postcode or BD100UN, say.]

Q7: *In the ideal case of 50%-50% splits on the Galtonboard, what is distribution in the 4 Galtonboard channels? Hint:* first split 1/2 & 1/2; 2nd split: 3/4 & 1/4; 3rd split: 3/8 & 1/2 & 1/8; final split and answer: 3/16 & 7/16 & … & 1/16. (See poster.)

Q8: *How often does such an extreme rainfall event occur? What is its chance of occurrence?*
a) 1/16 x 7/16=7/256; **b)** 1/16; **c)** 5/16x5/16=25/256; **d)** 7/16x1/16=7/256. (See poster.)

Q9: Extreme rainfall occurs circa 3% (2.73% to be precise) of the time on average.
What is then the return period for such an extreme flood event?
a) 256/7~36wd's or 6:06min; **b)** 120wd's or 20min; **c)** 16wd's or 160s. (See poster.)

Q10: *How do the two Galtonboard distributions compare to their ideal distributions?* See outcome (updates) on the Raspberry Pi (move the mouse & look at the serial monitor; printed lines with numbers per channel, normalised & ideal outcomes). *What can we do to improve the outcomes?*

Please note: most answers are found on the poster; you can also ask the wardens. Full answers and more found at:
https://github.com/obokhove/wetropolis20162020/tree/master/WetropolisQuizanswers