

# LOOK: Yale alum/UConn math prof makes Yale upset into exam question

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If there was ever going to be a place where athletics and academics collided in an elaborate mathematical word problem, you'd think it would be at an Ivy League school.

But it's actually happened at [UConn](#), the site of one of the biggest upsets in college hoops to date this season.

Last Friday [Yale](#) became the first Ivy team to knock off UConn in 28 years (Yale also being the last Ivy team to do it, in 1986) when Jack Montague cashed a trey in the closing seconds, right there in Gampel Pavilion.

All told, pretty stunning. If you missed it, take a look now.

In light of this, a Yale alumnus -- and current visiting assistant professor of mathematics at UConn -- twisted the proud win of his alma mater onto the bitter loss on his students in the form of an ornate word problem on a final exam.

"A very natural question to ask after the game is: how often does such an upset happen?" professor [Joe Chen](#) told CBSSports.com in an email. "So I set out and found all previous UConn-Ivy League matches from the 1980s using [Sports Reference](#). The fact that there were a sufficient number of sample size (31), plus the fact that the games are virtually independent (teams change, players change), means that the central limit theorem can be applied to a very good approximation!"

So Chen made his students deduce a word problem related to Yale's win probability against UConn in his Math 3160: Probability course. To reach this class, you have to pass calculus.

"My philosophy about teaching probability is to try to make the topics/problems as applicable to real life as possible," Chen said, naturally adding, "After all, what's the point of understanding the central limit theorem and the bell curve?"

Obviously, prof. Obviously.

"When I came to UConn, one of the things I want to do is to build in references to the men's/women's basketball program as much and as reasonably as possible," he said. "And probability is the best setting to achieve this."

Here's the problem, work included, just in case you maybe needed the help in getting to the conclusion.

**Problem 6: UConn men's basketball vs. Ivy League opponents**

Since the 1980-81 season, UConn men's basketball team has played 31 games against Ivy League opponents. And it has lost only twice: on Dec. 2, 1986 and on Dec. 5, 2014, both to Yale. For some perspectives, here are the relevant stats in a typical matchup:

Random variable	Stands for	Mean	St. Dev.
$X$	Points scored by UConn per game	75	15
$Y$	Points scored by Ivy League opponent per game	57	12

Also  $X$  and  $Y$  are not independent: the correlation between  $X$  and  $Y$  is  $\frac{5}{8}$ . Based on this information:

- (a) Show, via an explicit computation, that the standard deviation of  $X - Y$  is 12.

[Useful:  $12^2 = 144$ ,  $15^2 = 225$ .]

$$\text{Var}(X-Y) = \text{Cov}(X-Y, X-Y)$$

$$\begin{aligned} \stackrel{\substack{\text{bilinearity} \\ \text{of Cov}}}{=} & \text{Cov}(X, X) - 2\text{Cov}(X, Y) + \text{Cov}(Y, Y) \\ & = \text{Var}(X) - 2\text{Cov}(X, Y) + \text{Var}(Y) \quad (*) \end{aligned}$$

$$\text{Now } \text{Var}(X) = 15^2, \text{ Var}(Y) = 12^2, \text{ and}$$

$$\text{Cov}(X, Y) = \text{Corr}(X, Y) \cdot \sqrt{\text{Var}(X)} \cdot \sqrt{\text{Var}(Y)} = \frac{5}{8} \cdot 15 \cdot 12 = \frac{1}{2} \cdot 15^2.$$

$$\text{Thus } (*) = 15^2 - 2 \cdot \frac{1}{2} \cdot 15^2 + 12^2 = 12^2 \Rightarrow \boxed{\sigma(X-Y) = 12}$$

- (b) By the central limit theorem, the distribution of  $X - Y$  can be approximated by a normal distribution with mean  $75 - 57 = 18$  and standard deviation 12. Under this approximation, find  $P[X - Y < 0]$ , the probability that UConn loses to an Ivy League opponent in a typical matchup.

$$P[X-Y < 0] \approx P[18 + 12Z < 0] \text{ where } Z \stackrel{d}{=} N(0, 1)$$

$$= P[Z \leq -1.5]$$

$$= 1 - P[Z < +1.5]$$

$$= 1 - \Phi(1.5) = 1 - 0.9332 = \boxed{0.0668}$$

(About 7% : small probability, but not so small after all!)

In the end, Chen's deduction of the central limit theorem shows Yale's probability at 7 percent, though he said actually *dumbed down* the data here because -- and here's the fun part -- students were not allowed to use calculators on the final exam.

Bet you miss those days, don't you?

Chen also copped to wearing both a Yale sweatshirt and a UConn gym shirt while attending the game last Friday.

"To be honest, as much as I enjoyed Yale's win, I'm about equally upset with how UConn played the last three games," Chen said. "That being said, as mathematicians, one of the things we can explain is why/how things happen using quantitatively methods."

Something tells me Kevin Ollie won't be bringing in the professor to explain or correct Connecticut's 3-3 skittish start to the season.

For the accurate numbers, Chen provided the full history of UConn vs. Ivies dating back to the early 1980s. I'm taking his word here, as he said the true probability is closer to 9 percent.

"In any case, I hope the point is well taken," Chen said. "The probability of Ivy League opponents upsetting UConn is small, but NOT that small."