# Final Sp15 Q2

(d) $X$ and $Y$ are independent random variables modulo $n$. You don't know the distribution of $X$, but you know that $Y$ is uniformly distributed. What can you say about the distribution of $Z = X + Y \bmod n$? Justify your answer.

(e) $X$ and $Y$ are independent random variables with normal distribution with mean $m_1$ and $m_2$ respectively, and variance $\sigma_1^2$ and $\sigma_2^2$ respectively. Describe the distribution of $Z = X + Y$ (including mean and variance).

What if we are not told that X and Y are independent?

## Final Fa18 Q1h

True False

- [ ] [ ] For dependent random variables $X, Y$ and constants $a, b$, it is possible that $\mathbb{E}[aX + bY] \neq a\mathbb{E}[X] + b\mathbb{E}[Y]$.
- [ ] [ ] $\mathbb{E}[XY] = \mathbb{E}[X]\mathbb{E}[Y]$ if and only if $X$ and $Y$ are independent.
- [ ] [ ] Consider two random variables $X$ and $Y$ with ranges $\mathcal{A}_X$ and $\mathcal{A}_Y$, respectively. If there exist $a \in \mathcal{A}_X$ and $b \in \mathcal{A}_Y$ such that $\mathbb{P}[X = a, Y = b] = \mathbb{P}[X = a]\mathbb{P}[Y = b]$, then $X$ and $Y$ are independent.

## Q2

(m) Let $A$ and $B$ denote two events such that $A \subset B$. Suppose $\mathbb{P}[A] = a$ and $\mathbb{P}[B] = b$, and let $I_A$ and $I_B$ denote the indicator random variables for $A$ and $B$, respectively. Find $\mathrm{Cov}(I_A, I_B)$.