**Q1** Let $X$ and $Y$ have the joint probability density function given by $f(x, y) = 4xy$, if $(x, y) \in [0, 1] \times [0, 1]$, and 0 elsewhere. What is $\mathbb{E}(Y - X)^2$?     (A) 1/9     (B) 1/8     (C) 5/36     (D) 11/72     (E) Other

**Q2** Let $X$ and $Y$ have the joint probability density function given by $f(x, y) = 6(1 - y)$ if $0 \leq x \leq y \leq 1$, and 0 elsewhere. Find the marginal density function of $X$ at $x = 1/3$.

(A) 1/3          (B) 1/2          (C) 2/3          (D) 4/3          (E) other

**Q3** Let X and Y be as in Q2. By using the conditional density, find $P(Y > \frac{1}{2} | X = 1/3)$.

(A) 1/2          (B) 9/16          (C) 5/8          (D) 19/32          (E) Other

**Q4** Suppose $X$ and $Y$ are random variables with the following joint pmf. Are $X$ and $Y$ independent?

|   |   | Y |   |
|---|---|---|---|
| X | 1 | 2 | 3 |
| 1 | 1/18 | 1/9 | 1/6 |
| 2 | 1/9 | 1/6 | 1/18 |
| 3 | 1/6 | 1/18 | 1/9 |

(A) Yes                              (B) No