Probability mass functions; the CDF

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Practice problems

1. A random variable X has the following pmf: $p(0) = 0.7$, $p(1) = 0.2$, and $p(2) = 0.1$. Find the values of the cdf $F(0)$, $F(1)$, and $F(2)$.
2. Given a cdf $F(x)$ where $F(1) = 0.3$, $F(2) = 0.8$, and $F(3) = 1.0$, find the probability $P(1 < X \leq 3)$.
3. A discrete random variable Y has a cdf defined by $F(y) = 0.2$ for $0 \leq y < 1$, $F(y) = 0.5$ for $1 \leq y < 2$, and $F(y) = 1.0$ for $y \geq 2$. Find the pmf $p(y)$ for $y = 0, 1, 2$.

Solutions

1. A random variable X has the following pmf: $p(0) = 0.7$, $p(1) = 0.2$, and $p(2) = 0.1$. Find the values of the cdf $F(0)$, $F(1)$, and $F(2)$.

   - Step 1: $F(0) = p(0) = 0.7$.
   - Step 2: $F(1) = p(0) + p(1) = 0.7 + 0.2 = 0.9$.
   - Step 3: $F(2) = p(0) + p(1) + p(2) = 0.7 + 0.2 + 0.1 = 1.0$.

   Answer: F(0)=0.7, F(1)=0.9, F(2)=1.0

2. Given a cdf $F(x)$ where $F(1) = 0.3$, $F(2) = 0.8$, and $F(3) = 1.0$, find the probability $P(1 < X \leq 3)$.

   - Step 1: Use the formula $P(a < X \leq b) = F(b) - F(a)$.
   - Step 2: Substitute $a = 1$ and $b = 3$.
   - Step 3: $P(1 < X \leq 3) = F(3) - F(1) = 1.0 - 0.3 = 0.7$.

   Answer: 0.7

3. A discrete random variable Y has a cdf defined by $F(y) = 0.2$ for $0 \leq y < 1$, $F(y) = 0.5$ for $1 \leq y < 2$, and $F(y) = 1.0$ for $y \geq 2$. Find the pmf $p(y)$ for $y = 0, 1, 2$.

   - Step 1: $p(0) = F(0) - 0 = 0.2 - 0 = 0.2$.
   - Step 2: $p(1) = F(1) - F(0) = 0.5 - 0.2 = 0.3$.
   - Step 3: $p(2) = F(2) - F(1) = 1.0 - 0.5 = 0.5$.

   Answer: p(0)=0.2, p(1)=0.3, p(2)=0.5
