

2-fold Convolution  $X, Y$   $\downarrow$   
 $Z = X + Y$

Discrete  $X \sim P_X(X)$   $Y \sim P_Y(Y)$

$$\begin{aligned} P(Z=z) &= P\{X+Y=z\} \\ &= \sum_t \underbrace{P(X+Y=z | Y=t)}_{P(X=z-Y)} P(Y=t) \end{aligned}$$

$$f_Z^{(z)} = \int_t f_X^{(z-t)} \cdot f_Y^{(t)} dt$$

e.g.  $X_1 \sim \text{Poi}(\lambda_1) \perp\!\!\!\perp X_2 \sim \text{Poi}(\lambda_2)$   
 $\uparrow$   
独立

Find  $Y = X_1 + X_2 \sim \text{Poi}(\lambda_1 + \lambda_2)$

1. Using Convolution

2. Moment generating function

Ex 1.2.6

(a)