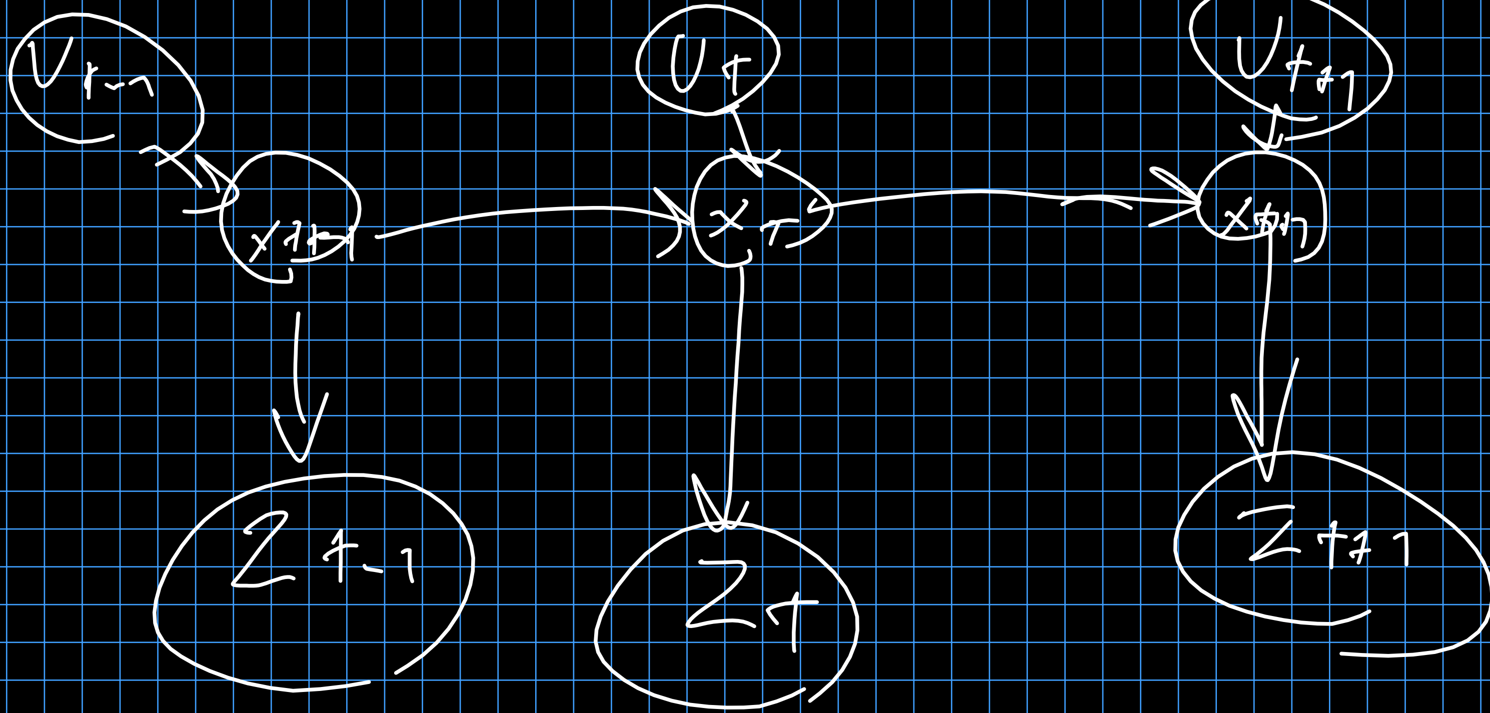
$$P(\text{open} \mid Z) \,?$$

Sensor Model: $P(z \mid x)$

Action Model: $P(x \mid u, x')$

Prior state $P(x)$



Markov process

$$Bel(x) = P(x_t \mid u_1, z_1, \ldots, u_t, z_t)$$

$$= \eta P(z_t \mid x_t, u_1, z_1, \ldots, u_t) P(x_t \mid u_1, z_1 \ldots u_t)$$

$$= \cancel{\eta P(z_t \mid x_t}$$

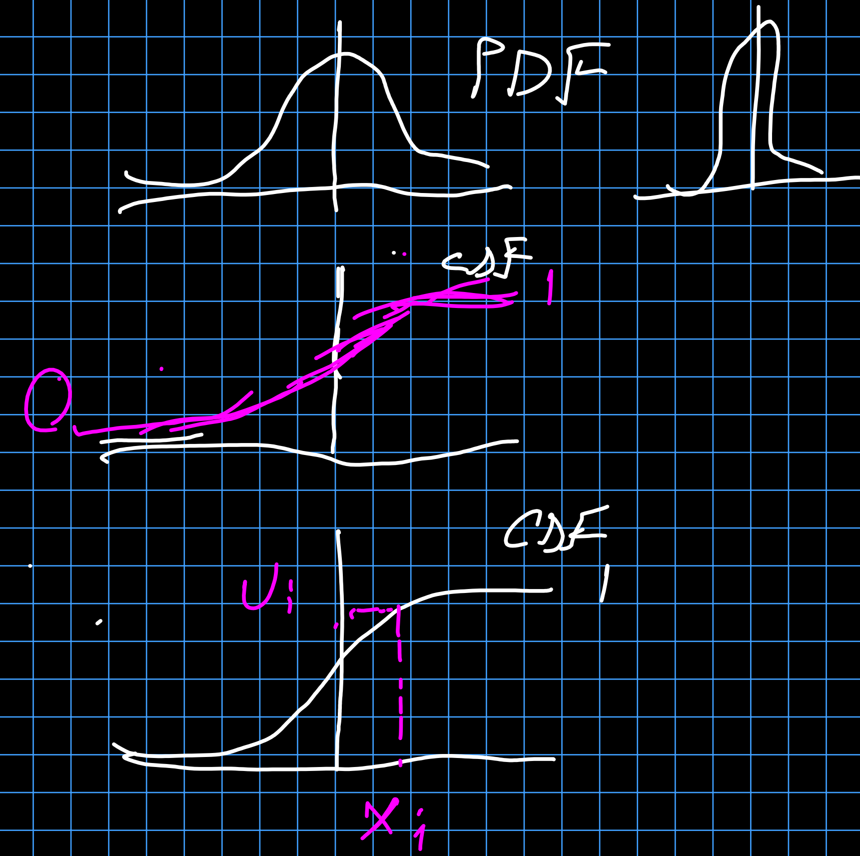
Particle : sample of distribution

Inverse Transform

① Find CDF^{-1}

② Draw $U_i \sim Uni(0,1)$

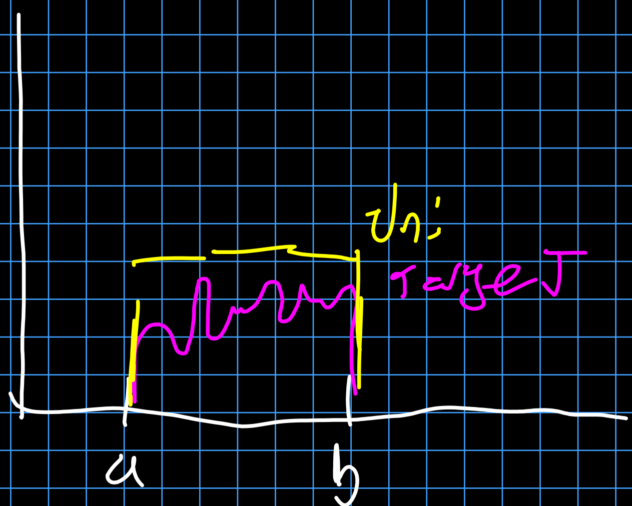
Compute $X_i = CDF^{-1}(U_i)$



Rejection Sampling

target dist - $P(x)$
proposal dist - $q(x)$

Setup: Choose $M > 1$
s.t.
$M\,q(x) > P(x)$ over
Support$(P(x))$



Support:
non-zero

① Sample $X_i \sim q(x)$
$U_i \sim \text{Uni}(0,1)$

② If $U_i\, M\, q(X_i) < P(X_i)$:
Accept X_i
Else Reject $\Rightarrow$ ①

Importance Sampling:

$$E[X] = \int x\, P(x)\, dx \Rightarrow E_p[X]$$

$$E_p[f(x)] = \int f(x) P(x)\, dx$$

$$= \int f(x) P(x) \frac{g(x)}{g(x)}\, dx = \int \frac{P}{g} f\, g\, dx$$

$$= E_g\left[\frac{P(x)}{g(x)} f(x)\right]$$

Generate lots of samples from g

$$E_p[f(x)] \approx \frac{1}{N} \sum f(x_i) \longleftrightarrow \frac{1}{N} \sum \frac{P(x_i)}{g(x_i)} f(x_i)$$

$x_i \sim P(x)$ $\qquad$ $x_i \sim g(x_i)$