Example Suppose $U_1, U_2, \ldots, U_{1000}$ are independent continuous uniform random variables, with U_j uniformly distributed on $[0,5]$.

So $\mu = E(X_j) = \frac{5}{2}$ and $\sigma^2 = Var(X_j) = \frac{25}{12}$.

Find an approximation to the probability that $U_1 + \ldots + U_{1000} \leq 2550$.

$$P\left(U_1 + \ldots + U_{1000} \leq 2550\right) = P\left(\frac{U_1 + \ldots + U_{1000} - (1000)(\frac{5}{2})}{\sqrt{1000(\frac{25}{12})}} \leq \frac{2550 - (1000)(\frac{5}{2})}{\sqrt{1000(\frac{25}{12})}}\right)$$

by CLT $\downarrow$

$$\approx P(Z \leq 1.09)$$
$$= F_Z(1.09)$$
$$= 0.8621$$

Notice we do not know how the sum $U_1 + \ldots + U_{1000}$ is distributed so this problem would be hopeless without CLT.