a) Define, 
\[ T_i := \text{i-th transaction, } i = 1, \ldots, 100 \]
\[ T_i' := \text{i-th transaction after rounding} \]
\[ E_i := T_i - T_i' = \text{error of the i-th transaction} \]
By the given \( E_i \)'s are iid w/ uniform dist.

\[ R(E_i) = \{-50, \ldots, 49\} \], where units are in cents.

\[ P(E_i = k) = \frac{1}{100}, \text{ } k \in R(E_i) \]

\[ \mu(E_i) = \sum_{k=-50}^{49} \frac{k}{100} = \frac{-50}{100} = -0.5 \] 

\[ \sigma^2(E_i) = \sum_{k=-50}^{49} (k - \mu(E_i))^2 P(E_i = k) = 25 + (\frac{49}{100}) (49)(50)(99) = 833.25 \]

\[ \text{Var}(E_i) = 833.25 \]

Next define, \( S := E_1 + \ldots + E_{100} = \text{cumulative error} \). We need \( P(S > 500) \)

\[ R(S) = \{-5000, \ldots, 4900, \ldots, 4900\} \], where units are in cents.

\[ \mu(S) = 100 \mu(E_i) = -50 \] 

\[ \sigma^2(S) = 10 \sigma^2(E_i) = 288.661 \] 

By the Central Limit Theorem, the dist of \( S \approx \mathcal{N}(-50, 288.661) \)

\[ P(S > 500) = P(Y > 500.5) + P(Y < -500.5) \]

Approximating with \( \Phi \):
\[ (1 - \Phi(1.91)) + \Phi(-1.56) \]

\[ = (1 - 0.9719) + 0.0668 = 0.0051 \]

b) \[ P(E_i = 0) = \frac{1}{9} \]
\[ P(E_i = k) = \frac{1}{99}, \text{ } k = \{-50, \ldots, 49\}, \text{ } k \neq 0 \]

\[ \mu(E_i) = \sum_{k=-50}^{49} \frac{k}{99} \cdot P(E_i = k) = \] 

\[ \sigma^2(E_i) = \sum_{k=-50}^{49} (k - \mu(E_i))^2 P(E_i = k) = 25 + (\frac{49}{99}) (49)(50)(99) = 631.29591368 \]

\[ \text{Var}(E_i) = 631.29591368 \]

\[ \sigma(E_i) = 25.12560275 \]

\[ E(S) = 100 \mu(E_i) = -37.87878788 \] 

\[ \sigma(S) = 10 \sigma(E_i) = 251.2560275 \]

\[ z_1 = \frac{500.5 - (-37.87878788)}{251.2560275} = 2.14 \]

\[ z_2 = \frac{-500.5 - (-37.87878788)}{251.2560275} = -1.84 \]

\[ P(S > 500) \approx P(Y > 500.5) + P(Y < -500.5) \]

\[ = 1 - \Phi(2.14) + \Phi(-1.84) \]

\[ = 1 - 0.9838 + 0.0329 \]