

UNIVERSITY OF TEXAS AT AUSTIN

Problem Set 3Payoff. Profit.

**Problem 3.1.** Let the current price of a non-dividend-paying stock be \$40. The continuously compounded, risk-free interest rate is 0.04. You model the distribution of the time-1 price of the above stock as follows:

$$S(1) \sim \begin{cases} 45, & \text{with probability } 1/4, \\ 42, & \text{with probability } 1/2, \\ 38, & \text{with probability } 1/4. \end{cases}$$

What is your expected profit under the above model, if you invest in one share of stock at time-0 and liquidate your investment at time-1?

**Solution:** The initial cost is  $S(0)$  and the payoff is  $S(T)$  with  $T = 1$ . So, the profit equals

$$S(T) - S(0)e^{rT}.$$

Thus, the expected profit equals

$$\mathbb{E}[S(T)] - S(0)e^{rT}.$$

According to the given model for the stock price, we have

$$\mathbb{E}[S(T)] = 45 \left( \frac{1}{4} \right) + 42 \left( \frac{1}{2} \right) + 38 \left( \frac{1}{4} \right) = 41.75.$$

Finally, the expected profit is

$$41.75 - 40e^{0.04} = 0.117569.$$

**Problem 3.2.** To plant and harvest 20,000 bushels of corn, Farmer Jayne incurs total aggregate costs totaling \$33,000. The current spot price of corn is \$1.80 per bushel. What is the profit if the spot price is \$1.90 per bushel when she harvests and sells her corn?

- (a) About \$3,000 gain
- (b) About \$3,000 loss
- (c) About \$5,000 loss
- (d) About \$5,000 gain
- (e) None of the above

**Solution: (d)**

$$1.90 \cdot 20,000 - 33,000 = 5,000$$