Financial Mathematics

One period pricing and hedging

0055-1. Borogrove company sells stock.
Current Borogrove price: \$2.50 per share.
Annual interest rate: 2.2%,
i.e., \$1 in bank becomes \$1.022 after one year
Gail promises to give Zach
100 shares of Borogrove
one year from now,
in return for x dollars (at that time).
Describe how Gail hedges this contract,
so as to eliminate all risk.
Compute the current value of this contract.
Compute the value of x
that makes the current value
of the contract equal to zero.

NOTE: This kind of contract is called a "forward" and, with proper hedging, you can compute the forward price x without modeling the stock price.

0055-2. Say risk-free factor $e^r = 1.002$.
Suppose we are tracking an asset, modeled
with uptick factor $e^u = 1.003$
and downtick factor $e^d = 0.998$.

a. Price a contract that pays \$1 on uptick,
\$0 on downtick.

b. Price a contract that pays \$0 on uptick,
\$1 on downtick.

c. Price a contract that pays \$1 on uptick,
\$1 on downtick.

d. Compare
(answer to a) + (answer to b)
with
answer to c.

0055-3. Say risk-free factor $e^r = 1.002$.
Suppose we are tracking an asset, modeled
with uptick factor $e^u = 1.003$
and downtick factor $e^d = 0.998$.

a. Hedge a contract that pays \$1 on uptick,
\$0 on downtick.

b. Hedge a contract that pays \$0 on uptick,
\$1 on downtick.

c. Hedge a contract that pays \$1 on uptick,
\$1 on downtick.

d. Compare

(answer to a) + (answer to b)

with

answer to c.