Chap. 20

#2

a) $V_H \equiv$ human wealth

$$V_H = 40\,000\left(1 + 1.05 + (1.05)^2\right)\cdot(0.75)$$

$$\boxed{V_H = 94\,575}$$

b) $V_{TOT} \equiv$ total wealth

$$V_{TOT} = V_H + V_{NH}$$

where $V_{NH} \equiv$ non-human wealth

$$\Rightarrow V_{TOT} = 94\,575 + 100\,000$$

$$\boxed{V_{TOT} = 194\,575}$$

c) $T \equiv$ total number of years left to live.

$$T = 3 + 7 = 10.$$

$$\Rightarrow AC = \frac{144\,575}{10} = 19\,457.5/\text{year}$$

$AC \equiv$ average (or constant) consumption level.

d) $V'_{TOT} = 194575 + 20000(0.75) = 209575$

$\Rightarrow AC' = \frac{\$214575}{10 \text{ years}} = \$20957.5/\text{year}$

She can increase the annual consumption level by \$1500.

e) $V''_{TOT} = 209575 + 7 \cdot 0.6 \cdot 40000 \cdot (1.05)^2$

$= 209575 + 7 \cdot 26460$

$= 394795$

N.B. • Earnings during last year of work $= 40000 \cdot (1.05)^2 = 44100$.

• Annual retirement earning $= 0.6(44100) = \$26460$.

• I assume first year bonus to still be given.

$\Rightarrow AC'' = \frac{\$394795}{10 \text{ years}} = \$39479.5/\text{year}$.

# 20.3 Investment Decision

$I_0 = \$100\ 000$

$\delta = 8\%.$

$\Pi_t = (1-\delta)^t\ 18\,000\$ \quad , t = 0, 1, 2, 3, \ldots$

N.B. I assume that $\Pi_0 = \$18\,000.$

The present value of the stream of future profits is

$$PV_0 = \$18\,000\left[1 + \frac{1-d}{1+r} + \left(\frac{1-d}{1+r}\right)^2 + \left(\frac{1-d}{1+r}\right)^3 + \ldots\right]$$

$$\Rightarrow \left(\frac{1-d}{1+r}\right) PV_0 = \$18\,000\left[\left(\frac{1-d}{1+r}\right) + \left(\frac{1-d}{1+r}\right)^2 + \ldots\right]$$

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$$\Rightarrow (1-B)\,PV_0 = \$18\,000$$

where $B = \dfrac{1-d}{1+r}$

$$\Rightarrow PV_0 = \left(\frac{1}{1-B}\right)\$18\,000$$

a) $\underline{r = 5\%}$ $\Rightarrow B = \dfrac{1-0.08}{1+0.05} = 0.876$

$$\Rightarrow \frac{1}{1-B} = 8.0645$$

$$\Rightarrow PV_0 = 8.0645 \cdot \$18\,000 = \boxed{\$145\ 161}$$

Since $PV_0 > I_0 = \$100\ 000$,
the manufacturer should buy
the machine.

b) $\underline{r = 10\%}$ $\Rightarrow B = \frac{1-0.08}{1.10} = 0.8364$

$$\Rightarrow \frac{1}{1-B} = 6.11$$

$\Rightarrow PV_0 = 6.11(18\ 000) = \$110\ 024$

Since $PV_0 > I_0$, at $r = 10\%$, the
investment is still worthwhile.

c) $\underline{r = 15\%}$: $B = \frac{1-0.08}{1+0.15} = 0.8$

$$\Rightarrow \frac{1}{1-B} = 5$$

$\Rightarrow PV_0 = 5 \cdot 18\ 000 = \$90\ 000 < I_0$.
With a rate of interest equal to
15%, the investment in a pretzel
machine is not worthwhile
anymore.

# #20.4) Investing in Education

a) We compare the values of human wealth in both cases:

let $V_H \equiv$ value of human wealth without further education

$$\Rightarrow V_H = 38(\$40\,000)(0.6) = \$912\,000.$$

let $V_H' \equiv$ value of human wealth with professional school.

$$V_H' = 36(\$40\,000 \cdot 1.10)(0.6) = \$950\,400.$$

N.B. The salary with professional school is $\$40\,000 \cdot 1.10 = \$44\,000$, but we must remove two years without salary.

For someone who considers only the average income over the life cycle, he would be willing to pay up to

$$\$950\,400 - \$912\,000 = \$38\,400.$$

in tuition fees.

b) Income tax = 30%:

$$\Rightarrow V_H = 38(40\,000)(0.7) = 1\,064\,000.$$

$$V_H' = 36(44\,000)(0.7) = 1\,108\,800$$

$\Rightarrow V_H' - V_H = \$44\,800 > \$38\,400 \Rightarrow$ lower income tax renders education investment more attractive.