PROBLEM SET: Discounting

Exercise 1. Project [2]
An investment project offers the following pattern of cash flows.

| Time $(t)$ | Cash Flow $\left(C_{T}\right)$ |
| :---: | ---: |
| 0 | $-\$ 1000$ |
| 1 | 500 |
| 2 | 750 |
| 3 | 250 |

The appropriate discount rate is $10 \%$.

1. What is the NPV of the investment project?

Exercise 2. Florida State Lottery (RWJ 4.6) [2]
You have won the Florida state lottery. Lottery officials offer you the choice of the following alternative pay-outs:
a) $\$ 10,000$ one year from now.
b) $\$ 20,000$ five years from now.

1. Which should you choose if the discount rate is
(a) $0 \%$.
(b) $10 \%$.
(c) $20 \%$.
2. Which rate makes the options equally attractive to you?

Exercise 3. Project [3]
A project is planned to give the following cash flows for the next 4 years:
$\left.\begin{array}{rlrrr}t & = & 1 & 2 & 3 \\ C_{t} & = & 400 & 450 & 400\end{array}\right) 100$

The project requires an initial investment of 1000. The relevant (annually compounded) interest rate is $14 \%$. Disregard taxes.

1. Should you invest in this project?

Exercise 4. [2]
The interest rate with semiannual compounding is $r_{n}=10 \%$.

1. Determine the equivalent interest rate with continous compounding.

Exercise 5. Compounding [2]
A bank quotes you a rate of interest of $14 \%$ per annum with quarterly compounding. What is the equivalent annual rate with

1. continuous compounding?
2. annual compounding?

Exercise 6. Compounding. (BM 3.16) [4]
For an investment of $\$ 1,000$ today, the Tiburon Finance Company is offering to pay you $\$ 1,600$ at the end of 8 years.

1. What is the annually compounded rate of interest?
2. What is the continuously compounded rate of interest?

Exercise 7. Savings [3]
Suppose you will need 50,000 ten years from now. You plan to make seven equal annual deposits beginning three years from today in an account that yields $11 \%$ compounded annually. How large should the annual deposit be?

## Exercise 8.

Recall the formula for calculating the present value for a constant annuity

$$
P V=C\left[\frac{1}{r}-\frac{1}{r(1+r)^{T}}\right]
$$

where the term in brackets is the annuity factor.
A growing annuity is an annuity where the cash flows increases by a growth rate $g$ each year.
Show that the corresponding annuity factor for a growing annuity is

$$
\left[\frac{1}{(r-g)}\right]\left[1-\left[\frac{(1+g)^{T}}{(1+r)^{T}}\right]\right]
$$

for a T period annuity, with growth rate $g$, discount rate $r$.

