Insert the following as Section 1.9, after Example 1.24 and before the Summary section.

1.9 R Laboratory

The functions `irm` and `idm` in **R Codes 1.1** compute the effective rate of interest i given $r^{(m)}$ and $d^{(m)}$, respectively.

```
#####################################################################
# R Codes 1.1
# Effective rate of interest
#
# irm(r,m) = effective rate of interest for nominal interest r
#            compounded m times per year
# idm(d,m) = effective rate of interest for nominal discount d
#            compounded m times per year
#####################################################################

irm=function(r,m) (1+r/m)^(m)-1          # Eq (1.11)
idm=function(d,m) (1-d/m)^(-m)-1         # Eq (1.19)
```

A sample of outputs using Examples 1.7 and 1.11 are as follows.

```
irm(0.115,12)           # Example 1.7
[1] 0.121259
idm(0.06,4)             # Example 1.11
[1] 0.0623193
```

We provide functions for evaluating different outputs of the Equation of Value in **R Codes 1.2**

```
#########################################################################
# R Codes 1.2
# Equation of Value (1.36), cash flows x start at 0 and end at n
#
# PV(x,i) = present value of x at effective rate i
# FV(x,i) = future value of x at effective rate i
# LP(pv,n,i) = n level payments x with present value equating
#              pv at effective rate i
# EI(pv,x) = effective rate for present value of x to equate pv
#########################################################################

PV=function(x,i)
  {n=(1:length(x)); sum(x*((1+i)^(-(n-1))))}
FV=function(x,i)
  {n=length(x)-(1:length(x)); sum(x*((1+i)^(n)))}
LP=function(pv,n,i)
  {a=(1-(1+i)^(-n))/i*(1+i); pv/a}
EI=function(pv,x)
  {uniroot(function(i) PV(x,i)-pv,lower=0,upper=1)$root}
```

We illustrate the use of these functions using Exercise 1.19, and Examples 1.23 and 1.24.

```
PV(c(950,800,150,400,120),0.02)           # Exercise 1.19
[1] 2366.28
(1.02)*FV(c(950,800,150,400,120),0.02)    # Exercise 1.19
[1] 2612.56
LP(10000/1.05^3,3,0.05)                   # Example 1.24
[1] 3021.03
EI(15000,c(0,7000,8500))                  # Example 1.23
[1] 0.0214628
```