MATHEMATICAL FINANCE PROJECT 5: A SIMPLE R PROGRAM TO COMPUTE BASIC ANNUITY PROBLEMS

BY

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This program consists of two major modules namely: **annuity immediate and annuity due.** Each of these modules are then subdivided into submodules depending on whether the annuity problem consists of level payments or nonlevel payments.

Included are other submodules that deal with nonlevel annuities that form decreasing sequence.

However, the program does not deal with interest rates(effective) since this can only be gotten through a trial and error methods (guess and check method). I tried to figure out how this guess and check method is achieved (the algorithm) but I couldn't. Most resources I checked didn't give a clear cut through this guess process and most talk of a certain annuity table.

Additionally, the program allows you to continue executing it as many times as you like provided you keep on inputting the correct numbers when prompted to do so.

Finally, this code can the ran(execute) just as that of project 4. That is enter 0 whenever you are prompted with **selection:** and enter the number corresponding to your choice for **s1:**

Below is a copy of the entire program. However, an r file of the program is also provided.

```
i <- 1

while (i < 10000000) {


print('Welcome to an R Program that solves basic Mathematical Finance Problems on Annuities.')


menu(c("PAYMENT IS MADE AT THE END OF EACH INTEREST PERIOD(ANNUIY IMMEDIATE)", "PAYMENT IS MADE AT THE BEGINING OF EACH INTEREST PERIOD(ANNUITY DUE)"), title="BELOW ARE TWO OPTIONS YOU SHOULD CHOOSE TO PROCEED WITH YOUR COMPUTATION. FIRST ENTER 0 FROM YOUR KEYBOARD FOR THE SELECTION OPTION THAT FOLLOWS THIS LIST, THEN RUN THE PROGRAM ONE TIME. SECONDLY, ENTER THE NUMBER THAT CORRESPONDS TO THE OPTION OF YOUR CHOICE FROM YOUR KEYBOARD AND THEN RUN YOUR PROGRAM AGAIN:" )

print('!!!!!!!!!!!!WARNING!!!!!!!!!! MAKE SURE YOUR CHOICE IS EITHER 1 OR 2 !!!!!!!!!!!!WARNING!!!!!!!!!!!!!!!!!!!')

D1 <- as.numeric (readline(prompt="ENTER THE NUMBER FOR THE SELECTED CHOICE? "))



if (D1==1){

  print('Welcome to the Annuity Immediate Module.')

  menu(c("LEVEL ANNUITIES", "NONLEVEL ANNUITIES"), title="BELOW ARE TWO OPTIONS YOU SHOULD CHOOSE TO PROCEED WITH YOUR
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```
COMPUTATION. FIRST ENTER 0 FROM YOUR KEYBOARD FOR THE
SELECTION OPTION THAT FOLLOWS THIS LIST, THEN RUN THE
PROGRAM ONE TIME. SECONDLY, ENTER THE NUMBER THAT
CORRESPONDS TO THE OPTION OF YOUR CHOICE FROM YOUR
KEYBOARD AND THEN RUN YOUR PROGRAM AGAIN:" )

 print('!!!!!!!!!!!!WARNING!!!!!!!!!! MAKE SURE YOUR CHOICE IS EITHER
1 OR 2 !!!!!!!!!!!!WARNING!!!!!!!!!!!!!!!!!!!')

 D <- as.numeric (readline(prompt="ENTER THE NUMBER FOR THE
SELECTED CHOICE? "))


 if (D==1){


    print('Welcome to the Annuity Immediate Module with Level Payments.')

    menu(c("PRESENT VALUE", "FUTURE VALUE", "PAYMENT",
"INVESTMENT TIME", "RATE"), title=" WHAT DO YOU WANT TO
CALCULATE? Choose a value for S1:")

    S1 <- as.numeric (readline(prompt="Enter the value of S1: "))


    if (S1==1){

      print('YOU WANT TO CALCULATE THE PRESENT VALUE OF YOUR
ANNUITY IMMEDIATE.')

      pmt <-  as.integer(readline(prompt="Enter the Payment Amount/Contribution:
"))

      r <-  as.numeric(readline(prompt="Enter the Effective Interest Rate per
Interest Period: "))

      t <-  as.integer(readline(prompt="Enter the Number of Interest Periods: "))

      pv = pmt*((1-(1+r)^(-t))/r)

      print(paste("YOUR PRESENT VALUE IS, PV = ", pv))
```

```
      print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

    } else if (S1==2){

      print('YOU WANT TO CALCULATE THE FUTERE VALUE OF YOUR ANNUITY IMMEDIATE.')

      pmt1 <-  as.integer(readline(prompt="Enter the Payment Amount/Contribution: "))

      r1 <-  as.numeric(readline(prompt="Enter the Effective Interest Rate per Interest Period: "))

      t1 <-  as.integer(readline(prompt="Enter the Number of Interest Periods: "))

      fv = pmt1*(((1+r1)^(t1)-1)/r1)

      print(paste("YOUR FUTURE VALUE IS, FV = ", fv))

      print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

    } else if (S1==3){

        menu(c("IF YOU WANT TO USE PRESENT VALUE", "IF YOU WANT TO USE FUTURE VALUE"), title="Choose a value for S1 to proceed with the calculation of Payment/Contribution, t:")

        SS2 <- as.numeric (readline(prompt="Enter the value of S1: "))


        if (SS2==1){

          print('YOU WANT TO CALCULATE THE Payment/Contribution OF YOUR ANNUITY IMMEDIATE USING THE PRESENT VALUE.')

          rr <-  as.numeric(readline(prompt="Enter the Effective Interest Rate per Interest Period: "))

          tt <-  as.integer(readline(prompt="Enter the Number of Interest Periods: "))

          ppv = (1-(1+rr)^(-tt))/rr
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```
        ppv3 <-  as.integer(readline(prompt="Enter the Amount you wish to
get(OR Present Value): "))

        ppmt = ppv3/ppv

        print(paste("YOUR PAYMENT/CONTRIBUTION IS, PMT = ", ppmt))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")


      } else if (SS2==2){

        print('YOU WANT TO CALCULATE THE Payment/Contribution OF
YOUR ANNUITY IMMEDIATE USING THE FUTURE VALUE.')

        rr1 <-  as.numeric(readline(prompt="Enter the Rate per Interest Period: "))

        tt1 <-  as.integer(readline(prompt="Enter the Number of Interest Periods:
"))

        ffv = ((1+rr1)^(tt1)-1)/rr1

        ppv3 <-  as.integer(readline(prompt="Enter the Amount you wish to
Accoumulate (Futur Value): "))

        ppmt = ppv3/ffv

        print(paste("YOUR PAYMENT/CONTRIBUTION IS, PMT = ", ppmt))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

        }


    } else if (S1==4){

     menu(c("IF YOU WANT TO USE PRESENT VALUE", "IF YOU WANT
TO USE FUTURE VALUE"), title="Choose a value for S1 to proceed with the
calculation of your investment time, t:")

     S2 <- as.numeric (readline(prompt="Enter the value of S1: "))
```

```
        if (S2==1){
          print('YOU WANT TO CALCULATE THE INVESTMENT TIME OF
YOUR ANNUITY IMMEDIATE USING THE PRESENT VALUE.')
          pv3 <-  as.integer(readline(prompt="Enter Present value: "))
          pmt3 <-  as.integer(readline(prompt="Enter the Payment/Conribution: "))
          r3 <-  as.numeric(readline(prompt="Enter the Effective Interest rate: "))
          t3 = -1*(log(1-(r3*pv3/pmt3)) /log(1+r3))
          print(paste("YOUR INVESTMENT TIME IS, T = ", t3))
          print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

        } else if (S2==2){
          print('YOU WANT TO CALCULATE THE INVESTMENT TIME OF
YOUR ANNUITY IMMEDIATE USING THE FUTURE VALUE.')
          fv3 <-  as.integer(readline(prompt="Enter future value: "))
          pmt3 <-  as.integer(readline(prompt="Enter the Payment/Conribution: "))
          r3 <-  as.numeric(readline(prompt="Enter the Effective Interest rate: "))
          t3 = log(1+(r3*fv3/pmt3))/log(1+r3)
          print(paste("YOUR INVESTMENT TIME IS, T = ", t3))
          print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
        }

    } else if (S1==5){
      print('YOU WANT TO CALCULATE THE EFFECTIVE INTEREST
RATE.')
      print('SORRY THIS MODULE IS NOT CURRENTLY AVAILABLE')
```

```
      print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM
TERMINATED!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
    }
  } else if (D==2){
    print('Welcome to the Annuity Immediate Module with NonLevel Payments.')
    menu(c("GEOMETRIC PROGRESSION", "ARITHMETIC
PROGRESSION"), title=" WHAT DO YOU WANT TO CALCULATE? Choose a
value for S1:")
    K1 <- as.numeric (readline(prompt="Enter the value of S1: "))
      if (K1==1){


        menu(c("PRESENT VALUE", "FUTURE VALUE"), title=" WHAT DO
YOU WANT TO CALCULATE? Choose a value for S1:")
        SK1 <- as.numeric (readline(prompt="Enter the value of S1: "))


        if (SK1==1){
          print('YOU WANT TO CALCULATE THE PRESENT VALUE OF
YOUR NONLEVEL ANNUITY WITH GEOMETRIC PROGRESSION.')
          npmt <-  as.integer(readline(prompt="Enter the Payment
Amount/Contribution: "))
          nr <-  as.numeric(readline(prompt="Enter the effective interest Rate per
Interest Period: "))
          ng <-  as.numeric(readline(prompt="Enter the Growth Rate: "))
          nt <-  as.integer(readline(prompt="Enter the Number of Interest Periods:
"))
            if (nr!=ng){
              jz <- ((1+ng)/(1+nr))^(nt)
```

```
            jz1 <- ((1+nr)-(1+ng))
            npv = npmt*((1-jz)/jz1)
            print(paste("YOUR PRESENT VALUE IS, PV = ", npv))
            print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM
TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
          }else if(nr==ng){
            npv = (nt*npmt)/(1+nr)
            print(paste("YOUR PRESENT VALUE IS, PV = ", npv))
            print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM
TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
          }

        } else if (SK1==2){
          print('YOU WANT TO CALCULATE THE FUTERE VALUE OF
YOUR NONLEVEL ANNUITY WITH GEOMETRIC PROGRESSION.')
          npmt1 <-  as.integer(readline(prompt="Enter the Payment
Amount/Contribution: "))
          nr1 <-  as.numeric(readline(prompt="Enter the effective interest Rate per
Interest Period: "))
          ng1 <-  as.numeric(readline(prompt="Enter the Growth Rate: "))
          nt1 <-  as.integer(readline(prompt="Enter the Number of Interest
Periods: "))

          nfv = npmt1*(((1+nr1)^(nt1) - (1+ng1)^(nt1))/(nr1-ng1))
          print(paste("YOUR FUTURE VALUE IS, FV = ", nfv))
          print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
        }
```

```
}else if (K1==2){

menu(c("FOR INCREASING ARITHMETIC PROGRESSION", "FOR DECREASING ARITHMETIC PROGRESSION"), title=" WHAT DO YOU WANT TO CALCULATE? Choose a value for S1:")

SSK1 <- as.numeric (readline(prompt="What is the value of S1? "))

if (SSK1==1){

menu(c("PRESENT VALUE", "FUTURE VALUE"), title=" WHAT DO YOU WANT TO CALCULATE? Choose a value for S1:")

SK1 <- as.numeric (readline(prompt="Enter the value of S1: "))

if (SK1==1){

print('YOU WANT TO CALCULATE THE PRESENT VALUE OF YOUR NONLEVEL ANNUITY WITH INCREASING ARITHMETIC PROGRESSION.')

pmTc <-  as.integer(readline(prompt="Enter the Payment Amount/Contribution: "))

qmTc <-  as.integer(readline(prompt="Enter the  Amount/Contribution of increase: "))

rc <-  as.numeric(readline(prompt="Enter the Effective Interest Rate per Interest Period: "))

tc <-  as.integer(readline(prompt="Enter the Number of Interest Periods: "))

pvc = pmTc*((1-(1+rc)^(-tc))/rc) + (qmTc/rc)*(((1-(1+rc)^(-tc))/rc)-tc*((1+rc)^(-tc)))

print(paste("YOUR PRESENT VALUE IS, PV = ", pvc))
```

```
            print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM
TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

          } else if (SK1==2){

            print('YOU WANT TO CALCULATE THE FUTERE VALUE OF
YOUR NONLEVEL ANNUITY WITH INCREASING ARITHMETIC
PROGRESSION.')

            pmTc1 <-  as.integer(readline(prompt="Enter the Payment
Amount/Contribution: "))

            qmTc <-  as.integer(readline(prompt="Enter the  Amount/Contribution
of increase: "))

            rc1 <-  as.numeric(readline(prompt="Enter the Rate per Interest
Period: "))

            tc1 <-  as.integer(readline(prompt="Enter the Number of Interest
Periods: "))

            fvc = pmTc1*(((1+rc1)^(tc1)-1)/rc1) + (qmTc/rc1)*((((1+rc1)^(tc1)-
1)/rc1)-tc1)



            print(paste("YOUR FUTURE VALUE IS, FV = ", fvc))

            print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM
TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

          }


        }else if (SSK1==2){

          menu(c("PRESENT VALUE", "FUTURE VALUE"), title=" WHAT DO
YOU WANT TO CALCULATE? Choose a value for S1:")

          SK1 <- as.numeric (readline(prompt="Enter the value of S1: "))


          if (SK1==1){
```

```
            print('YOU WANT TO CALCULATE THE PRESENT VALUE OF
YOUR NONLEVEL ANNUITY WITH DECREASING ARITHMETIC
PROGRESSION.')

            rx <-  as.numeric(readline(prompt="Enter the Effective Interest Rate
per Interest Period: "))

            tx <-  as.integer(readline(prompt="Enter the Number of Interest
Periods: "))

            pvx = (tx - ((1-(1+rx)^(-tx))/rx))/rx

            print(paste("YOUR PRESENT VALUE IS, PV = ", pvx))

            print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
          } else if (SK1==2){

            print('YOU WANT TO CALCULATE THE FUTERE VALUE OF
YOUR NONLEVEL ANNUITY WITH DECREASING ARITHMETIC
PROGRESSION.')

            rx1 <-  as.numeric(readline(prompt="Enter the Effective Interest Rate
per Interest Period: "))

            tx1 <-  as.integer(readline(prompt="Enter the Number of Interest
Periods: "))

            fvx = ((1+rx1)^(tx1))*((tx1 - ((1-(1+rx1)^(-tx1))/rx1))/rx)


            print(paste("YOUR FUTURE VALUE IS, FV = ", fvx))

            print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
          }


        }
       }
 }
```

```
} else if (D1==2){

  print('Welcome to the Annuity DUE Module.')


  menu(c("LEVEL ANNUITIES", "NONLEVEL ANNUITIES"), title="BELOW
ARE TWO OPTIONS YOU SHOULD CHOOSE TO PROCEED WITH YOUR
COMPUTATION. FIRST ENTER 0 FROM YOUR KEYBOARD FOR THE
SELECTION OPTION THAT FOLLOWS THIS LIST, THEN RUN THE
PROGRAM ONE TIME. SECONDLY, ENTER THE NUMBER THAT
CORRESPONDS TO THE OPTION OF YOUR CHOICE FROM YOUR
KEYBOARD AND THEN RUN YOUR PROGRAM AGAIN:" )

  print('!!!!!!!!!!!!WARNING!!!!!!!!!! MAKE SURE YOUR CHOICE IS EITHER
1 OR 2 !!!!!!!!!!!!WARNING!!!!!!!!!!!!!!!!!!!')

  Z <- as.numeric (readline(prompt="ENTER THE NUMBER FOR SELECTED
CHOICE? "))


     if (Z==1){

       menu(c("PRESENT VALUE", "FUTURE VALUE", "PAYMENT",
"INVESTMENT TIME", "RATE"), title=" WHAT DO YOU WANT TO
CALCULATE? Choose a value for S1:")

       SZ1 <- as.numeric (readline(prompt="Enter the value of S1: "))


       if (SZ1==1){

         print('YOU WANT TO CALCULATE THE PRESENT VALUE OF YOUR
ANNUITY DUE WITH LEVEL PAYMENTS.')
```

```
        Pmt <-  as.integer(readline(prompt="Enter the Payment
Amount/Contribution: "))

        R <-  as.numeric(readline(prompt="Enter the Rate per Interest Period: "))

        d <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest
Period: "))

        T <-  as.integer(readline(prompt="Enter the Investment time: "))

        Pv = Pmt*((1-(1+R)^(-T))/d)

        print(paste("YOUR PRESENT VALUE IS, PV = ", Pv))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

      } else if (SZ1==2){

        print('YOU WANT TO CALCULATE THE FUTERE VALUE OF YOUR
ANNUITY DUE WITH LEVEL PAYMENTS.')

        Pmt1 <-  as.integer(readline(prompt="Enter the Payment
Amount/Contribution: "))

        R1 <-  as.numeric(readline(prompt="Enter the Rate per Interest Period: "))

        d1 <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest
Period: "))

        T1 <-  as.integer(readline(prompt="Enter the Investment time: "))

        Fv = Pmt1*(((1+R1)^(T1)-1)/d1)

        print(paste("YOUR FUTURE VALUE IS, FV = ", Fv))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

      } else if (SZ1==3){

        menu(c("IF YOU WANT TO USE PRESENT VALUE", "IF YOU WANT
TO USE FUTURE VALUE"), title="Choose a value for S1 to proceed with the
calculation of Payment/Contribution, t:")

        SSZ2 <- as.numeric (readline(prompt="Enter the value of S1: "))
```

```
if (SSZ2==1){
  print('YOU WANT TO CALCULATE THE
Payment/Contribution(LEVEL PAYMENT) OF YOUR ANNUITY DUE USING
THE PRESENT VALUE.')
  R2 <-  as.numeric(readline(prompt="Enter the Rate per Interest Period: "))
  T2 <-  as.integer(readline(prompt="Enter the Investment time: "))
  d2 <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest
Period: "))
  Pv2 = (1-(1+R2)^(-T2))/d2
  Pv3 <-  as.integer(readline(prompt="Enter the Amount you wish to
get(borrow/PRESENT VALUE): "))
  Ppmt = Pv3/Pv2
  print(paste("YOUR PAYMENT/CONTRIBUTION IS, PMT = ", Ppmt))
  print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

} else if (SSZ2==2){
  print('YOU WANT TO CALCULATE THE
Payment/Contribution(LEVEL PAYMENTS) OF YOUR ANNUITY DUE USING
THE FUTURE VALUE.')
  R3 <-  as.numeric(readline(prompt="Enter the Rate per Interest Period: "))
  T3 <-  as.integer(readline(prompt="Enter the Investment time: "))
  d3 <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest
Period: "))
  Fv1 = ((1+R3)^(T3)-1)/d3
  Pv4 <-  as.integer(readline(prompt="Enter the Amount you wish to
Accoumulate/FUTURE VALUE: "))
```

```
        Ppmt1 = Pv4/Fv1
        print(paste("YOUR PAYMENT/CONTRIBUTION IS, PMT = ", Ppmt1))
        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
      }

    } else if (SZ1==4){
      menu(c("IF YOU WANT TO USE PRESENT VALUE", "IF YOU WANT TO USE FUTURE VALUE"), title="Choose a value for S1 to proceed with the calculation of your investment time, t:")
      SZ2 <- as.numeric (readline(prompt="What is the value of S1? "))

      if (SZ2==1){
        print('YOU WANT TO CALCULATE THE INVESTMENT TIME OF YOUR ANNUITY DUE MADE OF LEVEL PAYMENTS USING THE PRESENT VALUE.')
        Pv5 <-  as.integer(readline(prompt="Enter Present value: "))
        Pmt5 <-  as.integer(readline(prompt="Enter the Payment/Conribution: "))
        R5 <-  as.numeric(readline(prompt="Enter the rate: "))
        d5 <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest Period: "))
        T5 = -1*(log(1-(d5*Pv5/Pmt5))/log(1+R5))
        print(paste("YOUR INVESTMENT TIME IS, T = ", T5))
        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

      } else if (S2==2){
```

```
        print('YOU WANT TO CALCULATE THE INVESTMENT TIME OF
YOUR ANNUITY DUE MADE OF LEVEL PAYMENTS USING THE FUTURE
VALUE.')

        Fv6 <-  as.integer(readline(prompt="Enter future value: "))

        Pmt6 <-  as.integer(readline(prompt="Enter the Payment/Conribution: "))

        R6 <-  as.numeric(readline(prompt="Enter the rate: "))

        d6 <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest
Period: "))

        T6 = log(1+(d6*Fv6/Pmt6))/log(1+R6)

        print(paste("YOUR INVESTMENT TIME IS, T = ", T6))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

        }


    } else if (S1==5){

        print('YOU WANT TO CALCULATE THE INVESTMENT EFFECTIVE
INTEREST RATE OF YOUR ANNUITY DUE MADE OF LEVEL
PAYMENTS.')

        print('SORRY THIS MODULE IS NOT CURRENTLY AVAILABLE.')


        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM
TERMINATED!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

    }



} else if (Z==2){
```

```
menu(c("FOR INCREASING ARITHMETIC PROGRESSION", "FOR DECREASING ARITHMETIC PROGRESSION"), title=" WHAT DO YOU WANT TO CALCULATE? Choose a value for S1:")

SSKZ1 <- as.numeric (readline(prompt="Enter the value of S1: "))

if (SSKZ1==1){


 menu(c("PRESENT VALUE", "FUTURE VALUE"), title=" WHAT DO YOU WANT TO CALCULATE? Choose a value for S1:")

SKZ1 <- as.numeric (readline(prompt="Enter the value of S1: "))


 if (SKZ1==1){

  print('YOU WANT TO CALCULATE THE PRESENT VALUE OF YOUR NONLEVEL ANNUITY WITH INCREASING ARITHMETIC PROGRESSION.')

  PmTZC <-  as.integer(readline(prompt="Enter the Payment Amount/Contribution: "))

  qmTZc <-  as.integer(readline(prompt="Enter the  Amount/Contribution of increase: "))

  rZc <-  as.numeric(readline(prompt="Enter the Effective Interest Rate per Interest Period: "))

  dZ <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest Period: "))

  tZc <-  as.integer(readline(prompt="Enter the Number of Interest Periods: "))

  PvZ = PmTZC*((1-(1+rZc)^(-tZc))/dZ) + (qmTZc/dZ)*(((1-(1+rZc)^(-tZc))/rZc)-(tZc)*(1+rZc)^(-tZc))

  print(paste("YOUR PRESENT VALUE IS, PV = ", PvZ ))

  print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")
```

```
} else if (SKZ1==2){

print('YOU WANT TO CALCULATE THE FUTERE VALUE OF YOUR NONLEVEL ANNUITY WITH INCREASING ARITHMETIC PROGRESSION.')

pmTZc1 <-  as.integer(readline(prompt="Enter the Payment Amount/Contribution: "))

qmTZc1 <-  as.integer(readline(prompt="Enter the  Amount/Contribution of increase: "))

rZc1 <-  as.numeric(readline(prompt="Enter the Rate per Interest Period: "))

dZ1 <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest Period: "))

tZc1 <-  as.integer(readline(prompt="Enter the Number of Interest Periods: "))

fvcZ = pmTZc1*(((1+rZc1)^(tZc1)-1)/dZ1) + (qmTZc1/dZ1)*((((1+rZc1)^(tZc1)-1)/dZ1)-tZc1)

print(paste("YOUR FUTURE VALUE IS, FV = ", fvcZ))

print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

}


}else if (SSKZ1==2){

menu(c("PRESENT VALUE", "FUTURE VALUE"), title=" WHAT DO YOU WANT TO CALCULATE? Choose a value for S1:")

SKZ1 <- as.numeric (readline(prompt="Enter the value of S1: "))


if (SKZ1==1){
```

```
        print('YOU WANT TO CALCULATE THE PRESENT VALUE OF
YOUR NONLEVEL ANNUITY WITH DECREASING ARITHMETIC
PROGRESSION.')

        rZx <-  as.numeric(readline(prompt="Enter the Effective Interest Rate per
Interest Period: "))

        tZx <-  as.integer(readline(prompt="Enter the Number of Interest Periods:
"))

        dZx <-  as.numeric(readline(prompt="Enter the Discount Rate per Interest
Period: "))

        pvZx = (tZx - ((1-(1+rZx)^(-tZx))/rZx))/dZx

        print(paste("YOUR PRESENT VALUE IS, PV = ", pvZx))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

      } else if (SKZ1==2){

        print('YOU WANT TO CALCULATE THE FUTERE VALUE OF
YOUR NONLEVEL ANNUITY WITH DECREASING ARITHMETIC
PROGRESSION.')

        rZx1 <-  as.numeric(readline(prompt="Enter the Effective Interest Rate
per Interest Period: "))

        tZx1 <-  as.integer(readline(prompt="Enter the Number of Interest
Periods: "))

        dZx1 <-  as.numeric(readline(prompt="Enter the Discount Rate per
Interest Period: "))

        fvZx = ((1+rZx1)^(tZx1))*((tZx1 - ((1-(1+rZx1)^(-tZx1))/rZx1))/dZx1)

        print(paste("YOUR FUTURE VALUE IS, FV = ", fvZx))

        print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED
SUCCESSFULLY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")

      }
```

```
      }
    }



} else{
  print('!!!!!!!!!!!!!!!WARNING!!!!!!!!! MAKE SURE YOUR CHOICE IS EITHER 1 OR 2 !!!!!!!!!!!!!WARNING!!!!!!!!!!!!!!!!!!!')
  print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! PROGRAM TERMINATED!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!")


}


  i = i+1
}
```