

Package ‘DetLifeInsurance’

September 12, 2020

Type Package

Title Life Insurance Premium and Reserves Valuation

Version 0.1.3

Maintainer Joaquin Auza <auzajoaquin@gmail.com>

Description Methods for valuation of life insurance premiums and reserves (including variable-benefit and fractional coverage) based on “Actuarial Mathematics” by Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt (1997, ISBN: 978-0938959465), “Actuarial Mathematics for Life Contingent Risks” by Dickson, David C. M., Hardy, Mary R. and Waters, Howard R. (2009) <doi:10.1017/CBO9780511800146> and “Life Contingencies” by Jordan, C. W (1952) <doi:10.1017/S002026810005410X>. It also contains functions for equivalent interest and discount rate calculation, present and future values of annuities, and loan amortization schedule.

License GPL-3

Depends R (>= 3.5.0)

Imports utils

Encoding UTF-8

LazyData true

RoxygenNote 7.1.0

URL <https://github.com/JoaquinAuza/DetLifeInsurance>

BugReports <https://github.com/JoaquinAuza/DetLifeInsurance/issues>

VignetteBuilder knitr

Suggests knitr, rmarkdown

NeedsCompilation no

Author Joaquin Auza [aut, cre],
Maria Sol Alvarez [aut]

Repository CRAN

Date/Publication 2020-09-12 09:20:07 UTC

R topics documented:

a	4
A.	5
aCont	6
ACont.	7
aD	8
AD.	9
af	10
am	11
Am.	12
ArgentinaINDEC9092comb	13
ArgentinaINDEC9092F	14
ArgentinaINDEC9092M	14
av	15
Av.	16
avg	17
Avg.	19
CSO2001FALBnonsmoker	20
CSO2001FALBsmoker	21
CSO2001FANBnonsmoker	21
CSO2001FANBsmoker	22
CSO2001MALBnonsmoker	22
CSO2001MALBsmoker	23
CSO2001MANBnonsmoker	23
CSO2001MANBsmoker	24
CSO58FALB	24
CSO58FANB	25
CSO58MALB	25
CSO58MANB	26
CSO80FALB	26
CSO80FALBnonsmoker	27
CSO80FALBsmoker	27
CSO80FANB	28
CSO80FANBnonsmoker	28
CSO80FANBsmoker	29
CSO80MALB	29
CSO80MALBnonsmoker	30
CSO80MALBsmoker	30
CSO80MANB	31
CSO80MANBnonsmoker	31
CSO80MANBsmoker	32
E	32
Em	33
Fractional_table	34
GAM71F	35
GAM71M	35
GAM83F	36

GAM83M	36
GAM94F	37
GAM94FANB	37
GAM94M	38
GAM94MANB	38
JointSurvival	39
Loan_amortization	39
MAyP0206activeF	40
MAyP0206activeM	40
MAyP0206CAF	41
MAyP0206CAM	41
MAyP0206retiredF	42
MAyP0206retiredM	42
Mi06F	43
Mi06M	43
Mi85F	44
Mi85M	44
Payment_Protection	45
PremiumFrac	46
qfrac	47
Rate_converter	48
RV04F	48
RV04M	49
sf	49
Survival	50
Table_Dormoy	50
Table_Gompertz	51
Table_Makeham	52
Table_Moivre	53
V_a	53
V_A	55
V_aD	56
V_AD	57
V_av	59
V_Av	60
V_avg	62
V_Avg	64
V_E	65
V_Payment_Protection	66

a

*Life Annuities***Description**

Calculates the present value of a life annuity.

Usage

```
a(x, h, n, k = 1, i = 0.04, data, prop = 1, assumption = "none", cap = 1)
```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age, and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The annualized value of the payment.

Value

Returns a numeric value (actuarial present value).

References

Chapter 2 of Life Contingencies (1952) by Jordan, chapter 5 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
a(20, 0, 15, 1, 0.04, CS058FALB, 1, "none", 1200)
a(23, 7, 9, 1, 0.04, GAM71F, 1, "none", 5000)
a(33, 3, 10, 4, 0.04, CS080MANB, 1, "constant", 3000)
a(20, 5, 10, 4, 0.04, CS058MANB, 1, "UDD", 5000)
```

Description

Calculates the present value of the life insurance.

Usage

A.(x, h, n, k = 1, i = 0.04, data, prop = 1, assumption = "none", cap = 1)

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of fractions per year.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The value of the payment.

Value

Returns a numeric value (actuarial present value).

References

Chapter 3 of Life Contingencies (1952) by Jordan, chapter 4 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
A.(50,0,8,1,0.04,CS080MANB,1,"none",1)
A.(60,3,10,1,0.04,CS080MANB,1,"none",1)
A.(21,4,7,3,0.04,CS080MANB,1,"constant",1)
A.(23,4,6,12,0.04,CS080MANB,1,"UDD",1)
```

 aCont

Continuous Life Annuities

Description

Calculates the present value of a continuous life annuity.

Usage

```
aCont(x, h, n, i = 0.04, data, prop = 1, assumption = "constant", cap = 1)
```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths and "constant" for constant force of mortality).
cap	A numeric type value. The value of the payment.

Value

Returns a numeric value (the actuarial present value).

References

Chapter 2 of Life Contingencies (1952) by Jordan, chapter 5 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
aCont(35, 7, 10, 0.04, CS080MANB, 1, "constant", 1)
aCont(23, 5, 12, 0.04, CS080MANB, 1, "UDD", 1)
```

Description

Calculates the present value of a continuous life insurance.

Usage

```
ACont.(x, h, n, i = 0.04, data, prop = 1, assumption = "UDD", cap = 1)
```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths and "constant" for constant force of mortality).
cap	A numeric type value. The value of the payment.

Value

Returns a numeric (actuarial present value).

References

Chapter 3 of Life Contingencies (1952) by Jordan, chapter 4 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
ACont.(24, 2, 10, 0.04, CS080MANB, 1, "UDD", 1)
ACont.(24, 2, 10, 0.04, CS080MANB, 1, "constant", 1)
```

aD

*Decreasing Life Annuities***Description**

Calculates the present value of a decreasing life annuity.

Usage

```
aD(
  x,
  h,
  n,
  k = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap = 1
)
```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. The annualized value of the first payment.

Value

Returns a numeric value (actuarial present value).

References

Chapter 2 of Life Contingencies (1952) by Jordan, chapter 5 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
aD(27,0,3,1,0.04,CS080MANB,1,"none","none",1)
aD(32,2,8,1,0.04,CS080MANB,1,"none","none",1)
aD(35,8,15,4,0.04,CS080MANB,1,"constant","inter",1)
aD(21,2,5,4,0.04,CS080MANB,1,"UDD","inter",1)
aD(54,4,16,2,0.04,CS080MANB,1,"constant","intra",1)
aD(20,10,15,3,0.04,CS080MANB,1,"UDD","intra",1)
```

 AD.

Decreasing Life Insurance

Description

Calculates the present value of a decreasing life insurance.

Usage

```
AD.(
  x,
  h,
  n,
  k = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap = 1
)
```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Fractions per year.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.

prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. Amount insured for the first year/period.

Value

Returns a numeric value (actuarial present value).

References

Chapter 3 of Life Contingencies (1952) by Jordan, chapter 4 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

AD. (56,0,8,1,0.04,CS080MANB,1,"none","none",1)
 AD. (39,1,10,1,0.04,CS080MANB,1,"none","none",1)
 AD. (37,6,11,4,0.04,CS080MANB,1,"constant","inter",1)
 AD. (21,2,5,4,0.04,CS080MANB,1,"UDD","inter",1)
 AD. (54,4,16,2,0.04,CS080MANB,1,"constant","intra",1)
 AD. (20,10,15,3,0.04,CS080MANB,1,"UDD","intra",1)

af

Present Value of An Annuity

Description

Calculates the present value of an annuity.

Usage

af(l = 0, n, i)

Arguments

l 0 for annuity due or 1 for annuity immediate.
 n A numeric value. The number of payments.
 i A numeric value. The interest rate.

Examples

```
af(0,10,0.03)
af(1,15,0.05)
```

am

*Life Annuities for a group***Description**

Calculates the present value of a life annuity for a group.

Usage

```
am(
  x,
  h,
  n,
  k = 1,
  i = 0.04,
  data,
  prop = 1,
  type = "joint",
  quant = 1,
  assumption = "none",
  cap = 1
)
```

Arguments

x	A vector of integers representing the age of each individual of the group.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age, and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
type	A character string. Conditions to be met in order to access the benefit of the annuity ("joint", "exactly" or "atleast").
quant	An integer. Required only if type is not "joint". If type is "exactly" it represents the exact amount of survivors required for the endowment to be payed. If type is "atleast", it represents the minimum number of survivors required.

assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The annualized value of the payment.

Value

Returns a numeric value (actuarial present value).

Examples

```
ages<-c(23,34,21)
ages<-c(23,34,21)
am(ages,5,10,2,0.05,CS080MALB,1,"joint",assumption="UDD")
am(ages,0,20,1,0.06,CS080FALBsmoker,1,"atleast",1)
am(ages,2,15,2,0.07,CS080FANBsmoker,0.8,"exactly",2,"constant")
```

Am. *Life Insurance of a group*

Description

Calculates the present value of a life insurance coverage for a group.

Usage

```
Am. (
  x,
  h,
  n,
  k = 1,
  i = 0.04,
  data,
  prop = 1,
  ndeath = 1,
  assumption = "none",
  cap = 1
)
```

Arguments

x	A vector of intergers representing the age of each individual of the group.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of fractions per year.
i	The interest rate. A numeric type value.

data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
ndearth	An integer. Number of deaths necessary for payment to occur.
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The value of the payment.

Value

Returns a numeric value (actuarial present value).

Examples

```
ages<-c(22,33,44,55,66)
Am.(ages,5,15,1,0.04,CSO80MANB,1,2,"none",1)
Am.(ages,0,20,4,0.04,CSO80MANB,1,2,"UDD",1)
Am.(ages,10,25,2,0.04,CSO80MANB,1,2,"constant",1)
```

ArgentinaINDEC9092comb

ArgentinaINDEC9092 Males and Females Combined

Description

Mortality table (ultimate): Argentina Instituto Nacional de Estadística y Censos (INDEC). Nation: Argentina. Year: 1990-1992. Sex: Males and Females Combined.

Usage

```
data(ArgentinaINDEC9092comb)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20003>

ArgentinaINDEC9092F *ArgentinaINDEC9092 Female*

Description

Mortality table (ultimate): Argentina Instituto Nacional de Estadística y Censos (INDEC). Nation: Argentina. Year: 1990-1992. Sex: Female.

Usage

```
data(ArgentinaINDEC9092F)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20002>

ArgentinaINDEC9092M *ArgentinaINDEC9092 Male*

Description

Mortality table (ultimate): Argentina Instituto Nacional de Estadística y Censos (INDEC). Nation: Argentina. Year: 1990-1992. Sex: Male.

Usage

```
data(ArgentinaINDEC9092M)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20001>

Description

Calculates the present value of a varying life annuity according to an arithmetic progression.

Usage

```
av(
  x,
  h,
  n,
  k = 1,
  r = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap = 1
)
```

Arguments

x	An integer. The age on the insured.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
r	The variation rate. A numeric type value.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation is interannual or "intra" if it's intra-annual.
cap	A numeric type value. The annualized value of the first payment.

Value

Returns a numeric value (actuarial present value).

Note

For an increasing life annuity coverage, 'r' must be 1.

References

Chapter 5 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
av(33,0,5,1,0.8,0.04,CS080MANB,1,"none","none",1)
av(26,2,4,1,0.4,0.04,CS080MANB,1,"none","none",1)
av(26,1,5,4,0.5,0.04,CS080MANB,1,"constant","inter",1)
av(24,1,3,3,0.7,0.04,CS080MANB,1,"constant","intra",1)
av(35,4,6,6,0.4,0.04,CS080MANB,1,"UDD","inter",1)
av(40,3,7,2,0.7,0.04,CS080MANB,1,"UDD","intra",1)
```

 Av.

Varying Life Insurance: Arithmetic Progression

Description

Calculates the present value of a varying life insurance according to an arithmetic progression.

Usage

```
Av.(
  x,
  h,
  n,
  k = 1,
  r = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap = 1
)
```

Arguments

x	An integer. The age of the insured.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Fractions per year.

r	The variation rate. A numeric type value.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. Amount insured for the first year/period.

Value

Returns a numeric value (actuarial present value).

Note

For an increasing life insurance coverage, 'r' must be 1.

References

Chapter 4 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
Av. (43, 0, 4, 1, 0.7, 0.04, CS080MANB, 1, "none", "none", 1)
Av. (37, 1, 6, 1, 0.3, 0.04, CS080MANB, 1, "none", "none", 1)
Av. (25, 2, 3, 2, 0.6, 0.04, CS080MANB, 1, "constant", "inter", 1)
Av. (37, 3, 6, 4, 0.5, 0.04, CS080MANB, 1, "constant", "intra", 1)
Av. (40, 3, 5, 2, 0.4, 0.04, CS080MANB, 1, "UDD", "inter", 1)
Av. (50, 2, 4, 4, 0.6, 0.04, CS080MANB, 1, "UDD", "intra", 1)
```

Description

Calculates the present value of a varying life annuity according to a geometric progression.

Usage

```
avg(
  x,
  h,
  n,
  k = 1,
  r,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap = 1
)
```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
r	The variation rate. A numeric type value.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. The annualized value of the first payment.

Value

Returns a numeric value (actuarial present value).

References

Chapter 5 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```

avg(33,0,5,1,0.8,0.04,CS080MANB,1,"none","none",1)
avg(26,2,4,1,0.4,0.04,CS080MANB,1,"none","none",1)
avg(20,2,2,2,0.15,0.04,CS080MANB,1,"constant","inter",1)
avg(40,5,5,3,0.07,0.04,CS080MANB,1,"constant","intra",1)
avg(27,0,15,4,0.06,0.04,CS080MANB,1,"UDD","inter",1)
avg(34,7,12,6,0.03,0.04,CS080MANB,1,"UDD","intra",1)

```

Avg.

*Varying Life Insurance: Geometric Progression***Description**

Calculates the present value of a varying life insurance according to a geometric progression.

Usage

```

Avg.(
  x,
  h,
  n,
  k = 1,
  r,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap = 1
)

```

Arguments

x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Fractions per year.
r	The variation rate. A numeric type value.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).

assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. Amount insured for the first year/period.

Value

Returns a numeric value (actuarial present value).

References

Chapter 4 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

Avg. (33,0,5,1,0.8,0.04,CSO80MANB,1,"none","none",1)
 Avg. (26,2,4,1,0.4,0.04,CSO80MANB,1,"none","none",1)
 Avg. (25,0,15,2,0.25,0.04,CSO80MANB,1,"constant","inter",1)
 Avg. (37,10,10,4,0.05,0.04,CSO80MANB,1,"constant","intra",1)
 Avg. (40,5,20,6,0.04,0.04,CSO80MANB,1,"UDD","inter",1)
 Avg. (20,0,80,12,0.01,0.04,CSO80MANB,1,"UDD","intra",1)

CSO2001FALBnonsmoker *CSO2001 Female Age Last Birthday Non-smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Female. Basis: Age Last Birthday. Smoker: No.

Usage

```
data(CSO2001FALBnonsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1517>

CSO2001FALBsmoker	<i>CSO2001 Female Age Last Birthday Smoker</i>
-------------------	--

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Female. Basis: Age Last Birthday. Smoker: yes.

Usage

```
data(CSO2001FALBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1519>

CSO2001FANBnonsmoker	<i>CSO2001 Female Age Nearest Birthday Non-smoker</i>
----------------------	---

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Female. Basis: Age Nearest Birthday. Smoker: No.

Usage

```
data(CSO2001FANBnonsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1140>

CSO2001FANBsmoker *CSO2001 Female Age Nearest Birthday Smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Female. Basis: Age Nearest Birthday. Smoker: Yes.

Usage

```
data(CSO2001FANBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1141>

CSO2001MALBnonsmoker *CSO2001 Male Age Last Birthday Non-smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Male. Basis: Age Last Birthday. Smoker: No.

Usage

```
data(CSO2001MALBnonsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1516>

CSO2001MALBsmoker *CSO2001 Male Age Last Birthday Smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Male. Basis: Age Last Birthday. Smoker: yes.

Usage

data(CSO2001MALBsmoker)

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1518>

CSO2001MANBnonsmoker *CSO2001 Male Age Nearest Birthday Non-smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Male. Basis: Age Nearest Birthday. Smoker: No.

Usage

data(CSO2001MANBnonsmoker)

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1137>

CSO2001MANBsmoker *CSO2001 Male Age Nearest Birthday Smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 2001. Sex: Male. Basis: Age Nearest Birthday. Smoker: Yes.

Usage

```
data(CSO2001MANBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1138>

CSO58FALB *CSO58 Female Age Last Birthday*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Year: 1958. Nation: United States of America. Sex: Female. Basis: Age Last Birthday.

Usage

```
data(CSO58FALB)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=8>

CSO58FANB

CSO58 Female Age Nearest Birthday

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1958. Sex: Female. Basis: Age Nearest Birthday.

Usage

`data(CSO58FANB)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=6>

CSO58MALB

CSO58 Male Age Last Birthday

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1958. Sex: Male. Basis: Age Last Birthday.

Usage

`data(CSO58MALB)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=7>

CSO58MANB

CSO58 Male Age Nearest Birthday

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1958. Sex: Male. Basis: Age Nearest Birthday.

Usage

`data(CSO58MANB)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=5>

CSO80FALB

CSO80 Female Age Last Birthday

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Female Age method: Age Last Birthday.

Usage

`data(CSO80FALB)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=35>

CSO80FALBnonsmoker *CSO80 Female Age Last Birthday non-smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Female. Basis: Age Last Birthday. Smoker: No.

Usage

```
data(CSO80FALBnonsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=37>

CSO80FALBsmoker *CSO80 Female Age Last Birthday smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Female. Basis: Age Last Birthday. Smoker: Yes.

Usage

```
data(CSO80FALBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=39>

CSO80FANB

CSO80 Female Age Nearest Birthday

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Female. Basis: Age Nearest Birthday.

Usage

```
data(CSO80FANB)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=36>

CSO80FANBnonsmoker

CSO80 Female Age Nearest Birthday Non-smoker

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Female. Basis: Age Nearest Birthday. Smoker: No.

Usage

```
data(CSO80FANBnonsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=38>

CSO80FANBsmoker	<i>CSO80 Female Age Nearest Birthday Smoker</i>
-----------------	---

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Female. Basis: Age Nearest Birthday. Smoker: Yes.

Usage

```
data(CSO80FANBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=40>

CSO80MALB	<i>CSO80 Male Age Last Birthday</i>
-----------	-------------------------------------

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Male. Basis: Age Last Birthday.

Usage

```
data(CSO80MALB)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=41>

CSO80MALBnonsmoker *CSO80 Male Age Last Birthday Non-smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Male. Basis: Age Last Birthday. Smoker: No.

Usage

```
data(CSO80MALBnonsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=43>

CSO80MALBsmoker *CSO80 Male Age Last Birthday Smoker*

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Male. Basis: Age Last Birthday. Smoker: Yes.

Usage

```
data(CSO80MALBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=45>

CSO80MANB

CSO80 Male Age Nearest Birthday

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Male. Age method: Age Nearest Birthday.

Usage

`data(CSO80MANB)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=42>

CSO80MANBnonsmoker

CSO80 Male Age Nearest Birthday Non-smoker

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Male. Basis: Age Nearest Birthday. Smoker: No.

Usage

`data(CSO80MANBnonsmoker)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=44>

CSO80MANBsmoker	<i>CSO80 Male Age Nearest Birthday Smoker</i>
-----------------	---

Description

Mortality table (ultimate): Commissioner's Standard Ordinary. Nation: United States of America. Year: 1980. Sex: Male. Basis: Age Nearest Birthday. Smoker: Yes.

Usage

```
data(CSO80MANBsmoker)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=46>

E	<i>Pure Endowment</i>
---	-----------------------

Description

Calculates the Pure endowments.

Usage

```
E(x, n, i = 0.04, data, prop = 1, assumption = "none", cap = 1)
```

Arguments

x	An integer. The age of the insuree.
n	The term of the endowment. An integer, for annual coverage, or a numeric for fractional coverage.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The payment.

References

Chapter 2 of Life Contingencies (1952) by Jordan.

Examples

```
E(45,10,0.04,CS080MANB,1,"none",1000)
E(24,1.6,0.04,CS080MANB,1,"constant",17000)
E(26,2.4,0.04,CS058FALB,1,"UDD",3500)
```

Em	<i>Group Pure Endowment</i>
----	-----------------------------

Description

Calculates the Pure endowments for a group of insurees.

Usage

```
Em(
  x,
  n,
  i = 0.04,
  data,
  prop = 1,
  type = "joint",
  quant = 1,
  assumption = "none",
  cap = 1
)
```

Arguments

x	A vector of integers. The age of the insurees.
n	The term of the endowment. An integer, for annual coverage, or a numeric for fractional coverage.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
type	A character string. Conditions to be met in order to access the benefit of the endowment ("joint", "exactly" or "atleast").
quant	An integer. Required only if type is not "joint". If type is "exactly" it represents the exact amount of survivors required for the endowment to be payed. If type is "atleast", it represents the minimum number of survivors required.

assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The payment.

Examples

```

ages<-c(23,33,33)
Em(ages,15,0.04,CS080MANB,1,"joint")
Em(ages,20.5,0.04,CS080MANB,1,"joint",assumption = "constant",cap= 1)
Em(ages,10.5,0.04,CS080MANB,1,"joint",assumption = "UDD", cap=1)
ages<-c(20,23,24,25)
Em(ages,15,0.04,CS080MANB,1,"exactly",1,"none",1)
Em(ages,24.2,0.04,CS080MANB,1,"exactly",2,"constant",1)
Em(ages,8.2,0.04,CS080MANB,1,"exactly",3,"UDD",1)

ages<-c(40,42,56,57,58,59)
Em(ages,15,0.04,CS080MANB,1,"atleast",1,"none",1)
Em(ages,25.5,0.04,CS080MANB,1,"atleast",4,"constant",1)
Em(ages,15.3,0.04,CS080MANB,1,"atleast",3,"UDD",1)

```

Fractional_table	<i>Fractional table of mortality</i>
------------------	--------------------------------------

Description

Creates a fractional mortality table for a given mortality table.

Usage

```
Fractional_table(data, frac, i = 0.04, assumption = "UDD")
```

Arguments

data	A data.frame of the annual mortality table, with the first column being the age and the second one the probability of death.
frac	An integer. The number of fractions per year.
i	A numeric type value. The interest rate.
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths and "constant" for constant force of mortality).

Value

Returns a data.frame object containing fractional age and death probability vectors.

References

Chapter 3 of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt

Examples

```
Fractional_table(CS080MANB,2,0.04,"constant")
Fractional_table(CS080MANB,2,0.04,"UDD")
```

GAM71F

GAM71 Female

Description

Mortality table (ultimate): Group Annuity Mortality. Nation: United States of America. Year: 1971. Sex: Female.

Usage

```
data(GAM71F)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=817>, <http://servicios.infoleg.gob.ar/infolegInternet/anexos/80000-84999/81029/norma.htm>

GAM71M

GAM71 Male

Description

Mortality table (ultimate): Group Annuity Mortality. Nation: United States of America. Year: 1971. Sex: Male.

Usage

```
data(GAM71M)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=818>, <http://servicios.infoleg.gob.ar/infolegInternet/anexos/80000-84999/81029/norma.htm>

GAM83F

GAM83 Female

Description

Mortality table (ultimate): Group Annuity Mortality. Nation: United States of America. Year: 1983. Sex: Female.

Usage

`data(GAM83F)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=825>

GAM83M

GAM83 Male

Description

Mortality table (ultimate): Group Annuity Mortality. Nation: United States of America. Year: 1983. Sex: Male.

Usage

`data(GAM83M)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=826>

`GAM94F`*GAM94 Female*

Description

Mortality table (ultimate): Group Annuity Mortality. Year: 1994. Sex: Female.

Usage

```
data(GAM94F)
```

Format

a dataframe containing a column for age (x) and a column for death probability (q)

References

<https://mort.soa.org/>

`GAM94FANB`*GAM94 Female Age Nearest Birthday*

Description

Mortality table (ultimate): Group Annuity Mortality. Nation: United States of America. Year: 1994. Sex: Female. Basis: Age Nearest Birthday.

Usage

```
data(GAM94FANB)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=834>

GAM94M

GAM94 Male

Description

Mortality table (ultimate): Group Annuity Mortality. Year: 1994. Sex: Male.

Usage

```
data(GAM94M)
```

Format

a dataframe containing a column for age (x) and a column for death probability (q)

References

<https://mort.soa.org/>

GAM94MANB

GAM94 Male Age Nearest Birthday

Description

Mortality table (ultimate): Group Annuity Mortality. Nation: United States of America. Year: 1994. Sex: Male. Basis: Age Nearest Birthday.

Usage

```
data(GAM94MANB)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=835>

JointSurvival *Joint Survival Probability*

Description

Calculates the probability of survival given a mortality table for a group.

Usage

```
JointSurvival(x, n, data, prop = 1)
```

Arguments

x	A vector representing the age of each individual.
n	An integer. The term.
data	A data.frame of the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. The proportion of the mortality table used, between 0 and 1.

Examples

```
ages<-c(34,45,52,65)
JointSurvival(ages,10,CS080FALB)
```

Loan_amortization *Loan Amortization*

Description

Calculates the amortization schedule.

Usage

```
Loan_amortization(V0, n, i, i2 = 0, alic = 0, ins = 0, method)
```

Arguments

V0	A numeric type value. Loan value.
n	A numeric type value. The number of payments.
i	A numeric type value or a vector of them. The interest rate of the loan.
i2	A numeric type value. The interest rate of the saving account.
alic	A numeric type value. Interest tax rate.
ins	A numeric type value. The rate of V0 to be paid in each period.
method	A string. Amortization method used ("constant_installment","interest_only", "constant_principal", "interest_only_wsavings_account" or "constant_installment_varinrate").

Value

Returns a data.frame object containing Period, Payment, Pure Payment, Intrest, Amortization, Insurance, TAX and Outstanding debt.

Examples

```
Loan_amortization(1000,12,0.04,0,0.21,0.01,"constant_installment")
Loan_amortization(12000,15,0.04,0,0.21,0.01,"interest_only")
Loan_amortization(13000,10,0.04,0,0.21,0.01,"constant_principal")
Loan_amortization(15000,20,0.04,0.05,0.21,0.01,"interest_only_wsavings_account")
Loan_amortization(5000,5,0.04,0,0.21,0.01,"constant_installment_varintrate")
```

MAyP0206activeF

MAyP0206 Active Female

Description

Mortality table (ultimate): Mortalidad Activos y Pasivos. Nation: Argentina. Year: 2002-2006. Sex: Female. Status: Active.

Usage

```
data(MAyP0206activeF)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20005>

MAyP0206activeM

MAyP0206 Active Male

Description

Mortality table (ultimate): Mortalidad Activos y Pasivos. Nation: Argentina. Year: 2002-2006. Sex: Male. Status: Active.

Usage

```
data(MAyP0206activeM)
```


Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20004>

MAyP0206CAF

MAyP0206 Combined Active and Retired Female

Description

Mortality table (ultimate): Mortalidad Activos y Pasivos. Nation: Argentina. Year: 2002-2006.
Sex: Female. Status: Combined Active and Retired.

Usage

data(MAyP0206CAF)

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20009>

MAyP0206CAM

MAyP0206 Combined Active and Retired Male

Description

Mortality table (ultimate): Mortalidad Activos y Pasivos. Nation: Argentina. Year: 2002-2006.
Sex: Male. Status: Combined Active and Retired.

Usage

data(MAyP0206CAM)

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20008>

MAyP0206retiredF *MAyP0206 Retired Female*

Description

Mortality table (ultimate): Mortalidad Activos y Pasivos. Nation: Argentina. Year: 2002-2006.
Sex: Female. Status: Retired.

Usage

```
data(MAyP0206retiredF)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20007>

MAyP0206retiredM *MAyP0206 Retired Male*

Description

Mortality table (ultimate): Mortalidad Activos y Pasivos. Nation: Argentina. Year: 2002-2006.
Sex: Male. Status: Retired.

Usage

```
data(MAyP0206retiredM)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=20006>

Mi06F

Mi06 Female

Description

Mortality table (ultimate): Mortalidad Invalidez. Nation: Chile. Year: 2006. Sex: Female.

Usage

data(Mi06F)

Format

A data frame containing a column for age (x) and a column for death probability (q).

Note

for more information on how to adjust the values of the table using an 'improvement rate' visit:
<https://www.spensiones.cl/portal/compendio/596/w3-propertyvalue-3537.html>

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=2713>,<https://www.spensiones.cl/portal/compendio/596/w3-propertyvalue-3542.html>

Mi06M

Mi06 Male

Description

Mortality table (ultimate): Mortalidad Invalidez. Nation: Chile. Year: 2006. Sex: Male.

Usage

data(Mi06M)

Format

A data frame containing a column for age (x) and a column for death probability (q).

Note

For more information on how to adjust the values of the table using an 'improvement rate' visit:
<https://www.spensiones.cl/portal/compendio/596/w3-propertyvalue-3537.html>

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=2712>,<https://www.spensiones.cl/portal/compendio/596/w3-propertyvalue-3542.html>

Mi85F

Mi85 Female

Description

Mortality table (ultimate): Mortalidad Invalidez. Nation: Chile. Year: 1985. Sex: Female.

Usage

`data(Mi85F)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<http://servicios.infoleg.gob.ar/infolegInternet/anexos/80000-84999/81029/norma.htm>

Mi85M

Mi85 Male

Description

Mortality table (ultimate): Mortalidad Invalidez. Nation: Chile. Year: 1985. Sex: Male.

Usage

`data(Mi85M)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<http://servicios.infoleg.gob.ar/infolegInternet/anexos/80000-84999/81029/norma.htm>

Payment_Protection	<i>Payment Protection</i>
--------------------	---------------------------

Description

Calculates the present value of the loan insurance.

Usage

```
Payment_Protection(
  x,
  n,
  k = 1,
  v0,
  i = 0.04,
  ip = 0.04,
  data,
  prop = 1,
  type = "outstanding_debt",
  method = "interest_only"
)
```

Arguments

x	An integer. The age of the insuree.
n	An integer. Loan term (in years).
k	An integer. Number of payments per year.
v0	A numeric type value. Loan value.
i	The interest rate. A numeric type value.
ip	The interest rate of the loan. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).
type	A character string. The type of loan protection/reimbursement ("outstanding_debt" or "payments").
method	A character string. Amortization scheme ("constant_instalment", "interest_only" or "constant_principal").

Value

Returns a numeric value (actuarial present value).

Examples

```

Payment_Protection(35,2,1,1000000,0.04,0.06,CS080MANB,1,"payments","constant_instalment")
Payment_Protection(43,2,1,1000000,0.04,0.07,CS080MANB,1,"outstanding_debt","constant_instalment")
Payment_Protection(30,2,2,1000000,0.04,0.06,CS080MANB,1,"payments","constant_instalment")
Payment_Protection(20,2,2,1000000,0.04,0.07,CS080MANB,1,"outstanding_debt","constant_instalment")
Payment_Protection(33,2,1,1000000,0.04,0.05,CS080MANB,1,"payments","interest_only")
Payment_Protection(56,2,1,1000000,0.04,0.06,CS080MANB,1,"outstanding_debt","interest_only")
Payment_Protection(40,2,2,1000000,0.04,0.06,CS080MANB,1,"payments","interest_only")
Payment_Protection(25,2,2,1000000,0.04,0.05,CS080MANB,1,"outstanding_debt","interest_only")
Payment_Protection(23,2,1,1000000,0.04,0.07,CS080MANB,1,"payments","constant_principal")
Payment_Protection(35,2,1,1000000,0.04,0.06,CS080MANB,1,"outstanding_debt","constant_principal")
Payment_Protection(45,2,2,1000000,0.04,0.05,CS080MANB,1,"payments","constant_principal")
Payment_Protection(35,2,2,1000000,0.04,0.07,CS080MANB,1,"outstanding_debt","constant_principal")

```

PremiumFrac

Fractional Premium

Description

Calculates the annualized value of the fractional premiums.

Usage

```
PremiumFrac(px1, x, m, k, i = 0.04, data, prop = 1, effect = "yes", assumption)
```

Arguments

px1	A numeric type value. The value of the single net premium.
x	An integer. The age of the insuree.
m	An integer. Years of premium payment.
k	An integer. Number of premiums per year.
i	The interest rate. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
effect	A character string. This parameter indicates if, in the event of death, the insuree is released from paying the remaining fractional premiums of that year ("yes" or "no")
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths and "constant" for constant force of mortality).

Value

Returns the annualized value of the fractional premium.

Note

If $k=1$, regardless of the "effect", the returned value is the annual premium.

References

Chapter 4 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters

Examples

```
PremiumFrac(1000,20,10,2,0.04,CS080MANB,1,"yes","constant")
PremiumFrac(1000,20,10,2,0.04,CS080MANB,1,"no","UDD")
```

qfrac

*Fractional Probability of Death***Description**

Calculates the fractional probability for a person of $x+s/k$ dies before age $x+(s+1)/k$.

Usage

```
qfrac(x, s, k, i, data, assumption, prop)
```

Arguments

x	An integer. The age of the insuree.
s	An integer. Fraction of the year.
k	An integer. Number of fractions per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths and "constant" for constant force of mortality).
prop	A numeric value. It represents the proportion of the mortality table being used (between 0 and 1).

Value

The fractional probability of death.

Examples

```
qfrac(27,1,4,0.04,CS080MANB,"constant",1)
qfrac(20,0,12,0.04,CS080MANB,"UDD",0.8)
```

 Rate_converter

Interest & Discount Rate Converter

Description

Converts nominal and effective interest and discount rates.

Usage

```
Rate_converter(num, rate1, m, rate2, k, type = "days")
```

Arguments

num	A numeric type value. It is the interest/discount rate to be converted.
rate1	A string ("i", "d", "f" or "j"). Type of interest/discount rate to be converted.
m	number of capitalizations.
rate2	A string ("i" for effective interest rate, "d" for effective discount rate, "f" for nominal discount rate, "j" for nominal interest rate). Type of interest/discount rate to obtain.
k	An integer. Number of capitalizations per year.
type	A string. Reference for "k", indicating whether it is expressed as a fraction or as days ("frac" or "days").

Examples

```
Rate_converter(0.04, "i", 1, "i", 6, "frac")
Rate_converter(0.04, "f", 1, "j", 6, "frac")
Rate_converter(0.04, "f", 365, "d", 60, "days")
Rate_converter(0.04, "f", 365, "f", 60, "days")
```

 RV04F

RV04 Female

Description

Mortality table (ultimate): Renta Vitalicia. Nation: Chile. Year: 2004. Sex: Female.

Usage

```
data(RV04F)
```

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1500>

 RV04M

RV04 Male

Description

Mortality table (ultimate): Renta Vitalicia. Nation: Chile. Year: 2004. Sex: Male.

Usage

`data(RV04M)`

Format

A data frame containing a column for age (x) and a column for death probability (q).

References

<https://mort.soa.org/ViewTable.aspx?&TableIdentity=1499>

 sf

Future Value of an Annuity

Description

Calculates the future value of an annuity.

Usage

`sf(l = 0, n, i)`

Arguments

<code>l</code>	0 for annuity due or 1 for annuity immediate.
<code>n</code>	A numeric value. The number of payments.
<code>i</code>	A numeric value. The interest rate.

Examples

```
sf(0, 12, 0.05)
sf(1, 23, 0.04)
```

Survival	<i>Survival Probability</i>
----------	-----------------------------

Description

Calculates the probability of survival given a mortality table for an individual or a group.

Usage

```
Survival(x, n, data, prop = 1)
```

Arguments

x	An integer or a vector including only integers representing the age of each individual.
n	An integer. The term.
data	A data.frame of the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. The proportion of the mortality table used, between 0 and 1.

Examples

```
Survival(20, 2, CS058MANB, 1)
Survival(31, 33, CS080MANB, 0.8)
```

Table_Dormoy	<i>Dormoy's Law of Mortality Table Creator</i>
--------------	--

Description

Creates a mortality table under Dormoy's law.

Usage

```
Table_Dormoy(x0, omega, a)
```

Arguments

x0	A numeric type value. The initial age of the table.
omega	A numeric type value. The final age of the table.
a	A numeric type value. A parameter of the law.

Value

Returns a data.frame object containing age and death probabilities.

References

Chapter 3 (p 77-78) of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
Table_Dormoy(0, 100, 0.98)
```

Table_Gompertz	<i>Gompertz's Law of Mortality Table Creator</i>
----------------	--

Description

Creates a mortality table under Gompertz's law.

Usage

```
Table_Gompertz(x0, omega, B, C)
```

Arguments

x0	A numeric type value. The initial age of the table.
omega	A numeric type value. The final age of the table.
B	A numeric type value. A parameter of the law.
C	A numeric type value. A parameter of the law.

Value

Returns a data.frame object containing age and death probabilities.

References

Chapter 3 (p 77-78) of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
Table_Gompertz(0, 100, 0.00008, 1.07)
```

Table_Makeham

Makeham's Law of Mortality Table Creator

Description

Creates a mortality table under Makeham's law.

Usage

```
Table_Makeham(x0, omega, A, B, C)
```

Arguments

x0	A numeric type value. The initial age of the table.
omega	A numeric type value. The final age of the table.
A	A numeric type value. A parameter of the law.
B	A numeric type value. A parameter of the law.
C	A numeric type value. A parameter of the law.

Value

Returns a data.frame object containing age and death probabilities.

Note

The parameters are usually confined to the ranges shown below: $0.001 < A < 0.003$, $10^{(-6)} < B < 10^{(-3)}$, $1.08 < C < 1.12$.

References

Chapter 3 (p 77-78) of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

```
Table_Makeham(0, 100, 0.002, 3*10^(-4), 1.124)
```

Table_Moivre *de Moivre's Law of Mortality Table Creator*

Description

Creates a mortality table under de Moivre's law.

Usage

Table_Moivre(x0, omega)

Arguments

x0 A numeric type value. The initial age of the table.
 omega A numeric type value. The final age of the table.

Value

Returns a data.frame object containing age and death probabilities.

References

Chapter 3 (p 77-78) of Actuarial Mathematics (1997) by Bowers, Gerber, Hickman, Jones & Nesbitt.

Examples

Table_Moivre(0,100)

V_a *Reserve Valuation for Life Annuities*

Description

Calculates the reserve for the life Annuity up to the moment 't'.

Usage

V_a(
 px,
 x,
 h,
 n,
 k = 1,
 cantprem = 1,

```

premperyear = 1,
i = 0.04,
data,
prop = 1,
assumption = "none",
cap,
t
)

```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
cantprem	An integer. The total number of premiums.
premperyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The annualized value of the payment.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```

V_a(147.814202915034,20,5,10,1,5,1,0.04,CS080MANB,1,"none",100,15)
V_a(148.324902023591/12,20,5,10,4,60,12,0.04,CS080MANB,1,"constant",100,178)
V_a(223633.861110949,25,0,25,12,10,1,0.04,CS080MANB,1,"UDD",120000,300)

```

V_A. *Reserve for Life Insurance*

Description

Calculates the reserve for the life insurance up to the moment 't'.

Usage

```
V_A.(
  px,
  x,
  h,
  n,
  k = 1,
  cantprem = 1,
  premperyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of fractions per year.
cantprem	An integer. The total number of premiums.
premperyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage)
cap	A numeric type value. The value of the payment.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_A.(26673.3602688847,25,2,3,1,2,1,0.04,CS080MANB,1,"none",12000000,5)
V_A.(27446.2077993839/12,25,2,3,2,24,12,0.04,CS080MANB,1,"UDD",12000000,60)
V_A.(27376.5521158244/12,25,2,3,2,24,12,0.04,CS080MANB,1,"constant",12000000,60)
```

V_aD

Reserve Valuation for Decreasing life annuities

Description

Calculates the reserve for the decreasing life annuity up to the moment 't'.

Usage

```
V_aD(
  px,
  x,
  h,
  n,
  k = 1,
  cantprem = 1,
  prempyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.

n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
cantprem	An integer. The total number of premiums.
premperyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. The annualized value of the first payment.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_aD(139102.759700887,20,2,2,1,2,1,0.04,CS080MANB,1,"none","none",100000,4)
V_aD(140293.253997879/12,20,2,2,2,24,12,0.04,CS080MANB,1,"constant","inter",100000,48)
V_aD(23461.2532906378/12,20,2,2,2,24,12,0.04,CS080MANB,1,"constant","intra",10000,48)
V_aD(23462.5668144001/12,20,2,2,2,24,12,0.04,CS080MANB,1,"UDD","intra",10000,48)
V_aD(14029.8183844808/12,20,2,2,2,24,12,0.04,CS080MANB,1,"UDD","inter",10000,48)
```

V_AD.

Reserve Valuation for Decreasing Life Insurance

Description

Calculates the reserve for the decreasing life insurance up to the moment t.

Usage

```
V_AD.(
  px,
  x,
  h,
  n,
  k = 1,
  cantprem = 1,
  prempyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of fractions per year.
cantprem	An integer. The total number of premiums.
prempyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's inter-annual or "intra" if it's intra-annual.
cap	A numeric type value. Amount insured for the first year/period.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_AD. (251.489227521537,20,2,2,1,2,1,0.04,CSO80MANB,1,"none","none",100000,4)
V_AD. (432.974179723949/12,20,2,2,2,24,12,0.04,CSO80MANB,1,"UDD","intra",100000,48)
V_AD. (258.794207318685/12,20,2,2,2,24,12,0.04,CSO80MANB,1,"UDD","inter",100000,48)
V_AD. (412.784641829906/12,20,2,2,2,24,12,0.04,CSO80MANB,1,"constant","intra",100000,48)
V_AD. (258.189935788232/12,20,2,2,2,24,12,0.04,CSO80MANB,1,"constant","inter",100000,48)
```

V_av

Reserve Valuation for Varying Life Annuities: Arithmetic Progression

Description

Calculates the reserve for the Varying Life Annuity up to the moment t .

Usage

```
V_av(
  px,
  x,
  h,
  n,
  k = 1,
  r,
  cantprem = 1,
  prempyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insured.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.

r	The variation rate. A numeric type value.
cantprem	An integer. The total number of premiums.
prempyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. The annualized value of the first payment.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_av(9435943.49607651,20,2,2,1,0.05,2,1,0.04,CS080MANB,1,"none","none",10000000,4)
V_av(9516712.17583443/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"constant","inter",10000000,48)
V_av(9517.04683383614/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"UDD","inter",10000,48)
V_av(997.404109454868/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"constant","intra",1000,48)
V_av(997436.738989113/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"UDD","intra",1000000,48)
V_av(28.4421691213902,40,3,7,2,0.7,1,1,0.04,CS080MANB,1,"UDD","intra",1,120)
```

V_Av.

Reserve Valuation for Varying Life Insurance: Arithmetic Progression

Description

Calculates the reserve for the varying life insurance up to the moment t.

Usage

```
V_Av.(
  px,
  x,
  h,
  n,
  k = 1,
  r,
  cantprem = 1,
  premperyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of fractions per year.
r	The variation rate. A numeric type value.
cantprem	An integer. The total number of premiums.
premperyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. Amount insured for the first year/period.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_Av. (333.373580168544, 20, 2, 2, 1, 0.05, 1, 1, 0.04, CSO80MANB, 1, "none", "none", 100000, 4)
V_Av. (175.054867728107/12, 20, 2, 2, 2, 0.05, 24, 12, 0.04, CSO80MANB, 1, "UDD", "inter", 100000, 48)
V_Av. (183.436285298212/12, 20, 2, 2, 2, 0.05, 24, 12, 0.04, CSO80MANB, 1, "UDD", "intra", 100000, 48)
V_Av. (183.965812992762/12, 20, 2, 2, 2, 0.05, 24, 12, 0.04, CSO80MANB, 1, "constant", "intra", 100000, 48)
V_Av. (174.645127871177/12, 20, 2, 2, 2, 0.05, 24, 12, 0.04, CSO80MANB, 1, "constant", "inter", 100000, 48)
```

V_avg

Reserve Valuation for Varying Life Annuities: Geometric Progression

Description

Calculates the reserve for the Varying Life Annuity up to the moment t.

Usage

```
V_avg(
  px,
  x,
  h,
  n,
  k = 1,
  r,
  cantprem = 1,
  prempyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of payments per year.
r	The variation rate. A numeric type value.
cantprem	An integer. The total number of premiums.
premperyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. The annualized value of the first payment.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_avg(94359.4349607651,20,2,2,1,0.05,2,1,0.04,CSO80MANB,1,"none","none",100000,4)
V_avg(95167.1217583443/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"constant","inter",100000,48)
V_avg(99969.5282890978/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"constant","intra",100000,48)
V_avg(95170.4683383614/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"UDD","inter",100000,48)
V_avg(99972.7870462341/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"UDD","intra",100000,48)
```

V_Avg.

Reserve Valuation for Varying Life Insurance: Geometric Progression

Description

Calculates the reserve for the varying life insurance up to the moment t .

Usage

```
V_Avg.(
  px,
  x,
  h,
  n,
  k = 1,
  r,
  cantprem = 1,
  prempyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  variation = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
h	An integer. The deferral period.
n	An integer. Number of years of coverage.
k	An integer. Number of fractions per year.
r	The variation rate. A numeric type value.
cantprem	An integer. The total number of premiums.
prempyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).

assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
variation	A character string. "inter" if the variation it's interannual or "intra" if it's intra-annual.
cap	A numeric type value. Amount insured for the first year/period.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_Avg.(170.113596880528,20,2,2,1,0.05,2,1,0.04,CS080MANB,1,"none","none",100000,4)
V_Avg.(183.854458536232/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"UDD","intra",100000,48)
V_Avg.(175.054867728107/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"UDD","inter",100000,48)
V_Avg.(184.431102889578/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"constant","intra",100000,48)
V_Avg.(174.645127871158/12,20,2,2,2,0.05,24,12,0.04,CS080MANB,1,"constant","inter",100000,48)
```

V_E

Reserve Valuation for Pure Endowments

Description

Calculates the reserve for the Pure endowments up to the moment t.

Usage

```
V_E(
  px,
  x,
  n,
  cantprem = 1,
  prempyear = 1,
  i = 0.04,
  data,
  prop = 1,
  assumption = "none",
  cap,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
n	The term of the endowment. An integer, for annual coverage, or a numeric for fractional coverage.
cantprem	An integer. The total number of premiums.
prempyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
data	A data.frame containing the mortality table, with the first column being the age and the second one, the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
assumption	A character string. The assumption used for fractional ages ("UDD" for uniform distribution of deaths, "constant" for constant force of mortality and "none" if there is no fractional coverage).
cap	A numeric type value. The payment.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

A data frame with Premium, Risk, 1/E and reserve values up to the moment t.

References

Chapter 5 of Life Contingencies (1952) by Jordan, Chapter 11 of Actuarial Mathematics for Life Contingent Risks (2009) by Dickson, Hardy and Waters.

Examples

```
V_E(663.501989747591,20,10,1,1,0.04,CS080MANB,1,"none",1000,10)
V_E(9383.64446819386/12,20,2,12,12,0.04,CS080MANB,1,"constant",10000,24)
V_E(9383.64446819386/12,20,2,12,12,0.04,CS080MANB,1,"constant",10000,24)
```

V_Payment_Protection *Reserve valuation for Payment Protection*

Description

Calculates the reserve for the loan insurance up to the moment t.

Usage

```
V_Payment_Protection(
  px,
  x,
  n,
  k = 1,
  cantprem = 1,
  premperyear = 1,
  i = 0.04,
  ip = 0.04,
  data,
  prop = 1,
  type = "outstanding_debt",
  method = "interest_only",
  V0,
  t
)
```

Arguments

px	A numeric value. The value of the premium paid in each period.
x	An integer. The age of the insuree.
n	An integer. Loan term (in years).
k	An integer. Number of payments per year.
cantprem	An integer. The total number of premiums.
premperyear	An integer. The number of premiums to be paid per year.
i	The interest rate. A numeric type value.
ip	The interest rate of the loan. A numeric type value.
data	A data.frame of the mortality table, with the first column being the age and the second one the probability of death.
prop	A numeric value. It represents the proportion of the mortality table used (between 0 and 1).
type	A character string. The type of loan protection/reimbursement ("outstanding_debt" or "payments").
method	A character string. Amortization scheme ("constant_instalment", "interest_only" or "constant_principal").
V0	A numeric type value. Loan value.
t	An integer. The moment of valuation (in months if it is a fractional coverage or in years if it is not).

Value

Returns the actuarial present value of the loan protection.

Examples

```
px1<-31.6216618772779
```

```
c1<-10500
```

```
V_Payment_Protection(px1,30,25,1,10,1,0.06,0.07,CS080FANB,1,"payments","constant_instalment",c1,25)
```

Index

- * **Amortization**
 - Loan_amortization, 39
- * **Annuities**
 - a, 4
 - aCont, 6
 - aD, 8
 - am, 11
 - av, 15
 - avg, 17
 - V_a, 53
 - V_aD, 56
 - V_AD., 57
 - V_av, 59
 - V_avg, 62
- * **Annuity**
 - af, 10
 - sf, 49
- * **Arithmetic**
 - av, 15
 - Av., 16
 - V_av, 59
 - V_Av., 60
- * **Continuous**
 - aCont, 6
 - ACont., 7
- * **Decreasing**
 - aD, 8
 - AD., 9
 - V_aD, 56
 - V_AD., 57
- * **Discount**
 - Rate_converter, 48
- * **Dormoy's**
 - Table_Dormoy, 50
- * **Endowments**
 - V_E, 65
- * **Endowment**
 - E, 32
 - Em, 33
- * **Fractional**
 - Fractional_table, 34
 - PremiumFrac, 46
 - qfrac, 47
- * **Future**
 - sf, 49
- * **Geometric**
 - avg, 17
 - Av., 19
 - V_avg, 62
 - V_Avg., 64
- * **Gompertz's**
 - Table_Gompertz, 51
- * **Group**
 - am, 11
 - Am., 12
- * **Insurance**
 - A., 5
 - ACont., 7
 - AD., 9
 - Am., 12
 - Av., 16
 - Av., 19
 - V_A., 55
 - V_Av., 60
 - V_Avg., 64
- * **Interest**
 - Rate_converter, 48
- * **Joint**
 - JointSurvival, 39
- * **Life**
 - a, 4
 - A., 5
 - aCont, 6
 - ACont., 7
 - aD, 8
 - AD., 9
 - am, 11
 - Am., 12

- av, [15](#)
- Av., [16](#)
- avg, [17](#)
- Avg., [19](#)
- V_a, [53](#)
- V_A., [55](#)
- V_aD, [56](#)
- V_AD., [57](#)
- V_av, [59](#)
- V_Av., [60](#)
- V_avg, [62](#)
- V_Avg., [64](#)
- * **Loan**
 - Loan_amortization, [39](#)
- * **Makeham's**
 - Table_Makeham, [52](#)
- * **Moivre's**
 - Table_Moivre, [53](#)
- * **Mortality.**
 - Fractional_table, [34](#)
- * **Payment**
 - Payment_Protection, [45](#)
 - V_Payment_Protection, [66](#)
- * **Premium**
 - PremiumFrac, [46](#)
- * **Present**
 - af, [10](#)
- * **Probability**
 - JointSurvival, [39](#)
 - Survival, [50](#)
- * **Progression**
 - av, [15](#)
 - Av., [16](#)
 - avg, [17](#)
 - Avg., [19](#)
 - V_av, [59](#)
 - V_Av., [60](#)
 - V_avg, [62](#)
 - V_Avg., [64](#)
- * **Protection**
 - Payment_Protection, [45](#)
 - V_Payment_Protection, [66](#)
- * **Pure**
 - E, [32](#)
 - Em, [33](#)
 - V_E, [65](#)
- * **Rate**
 - Rate_converter, [48](#)
- * **Reserve**
 - V_a, [53](#)
 - V_A., [55](#)
 - V_aD, [56](#)
 - V_AD., [57](#)
 - V_av, [59](#)
 - V_Av., [60](#)
 - V_avg, [62](#)
 - V_Avg., [64](#)
 - V_E, [65](#)
- * **Survival**
 - JointSurvival, [39](#)
 - Survival, [50](#)
- * **Table**
 - Fractional_table, [34](#)
- * **Value**
 - af, [10](#)
 - sf, [49](#)
- * **Varying**
 - V_aD, [56](#)
 - V_AD., [57](#)
 - V_av, [59](#)
 - V_Av., [60](#)
 - V_avg, [62](#)
 - V_Avg., [64](#)
- * **datasets**
 - ArgentinaINDEC9092comb, [13](#)
 - ArgentinaINDEC9092F, [14](#)
 - ArgentinaINDEC9092M, [14](#)
 - CS02001FALBnonsmoker, [20](#)
 - CS02001FALBsmoker, [21](#)
 - CS02001FANBnonsmoker, [21](#)
 - CS02001FANBsmoker, [22](#)
 - CS02001MALBnonsmoker, [22](#)
 - CS02001MALBsmoker, [23](#)
 - CS02001MANBnonsmoker, [23](#)
 - CS02001MANBsmoker, [24](#)
 - CS058FALB, [24](#)
 - CS058FANB, [25](#)
 - CS058MALB, [25](#)
 - CS058MANB, [26](#)
 - CS080FALB, [26](#)
 - CS080FALBnonsmoker, [27](#)
 - CS080FALBsmoker, [27](#)
 - CS080FANB, [28](#)
 - CS080FANBnonsmoker, [28](#)
 - CS080FANBsmoker, [29](#)
 - CS080MALB, [29](#)

- CS080MALBnonsmoker, 30
- CS080MALBsmoker, 30
- CS080MANB, 31
- CS080MANBnonsmoker, 31
- CS080MANBsmoker, 32
- GAM71F, 35
- GAM71M, 35
- GAM83F, 36
- GAM83M, 36
- GAM94F, 37
- GAM94FANB, 37
- GAM94M, 38
- GAM94MANB, 38
- MAYP0206activeF, 40
- MAYP0206activeM, 40
- MAYP0206CAF, 41
- MAYP0206CAM, 41
- MAYP0206retiredF, 42
- MAYP0206retiredM, 42
- Mi06F, 43
- Mi06M, 43
- Mi85F, 44
- Mi85M, 44
- RV04F, 48
- RV04M, 49
- * **death**
 - qfrac, 47
- * **de**
 - Table_Moivre, 53
- * **law**
 - Table_Dormoy, 50
 - Table_Gompertz, 51
 - Table_Makeham, 52
 - Table_Moivre, 53
- * **mortality**
 - Table_Dormoy, 50
- * **of**
 - Fractional_table, 34
 - qfrac, 47
- * **probability**
 - qfrac, 47
- * **table.**
 - Table_Dormoy, 50
 - Table_Gompertz, 51
 - Table_Makeham, 52
 - Table_Moivre, 53
- * **table**
 - ArgentinaINDEC9092comb, 13
 - ArgentinaINDEC9092F, 14
 - ArgentinaINDEC9092M, 14
 - CS02001FALBnonsmoker, 20
 - CS02001FALBsmoker, 21
 - CS02001FANBnonsmoker, 21
 - CS02001FANBsmoker, 22
 - CS02001MALBnonsmoker, 22
 - CS02001MALBsmoker, 23
 - CS02001MANBnonsmoker, 23
 - CS02001MANBsmoker, 24
 - CS058FALB, 24
 - CS058FANB, 25
 - CS058MALB, 25
 - CS058MANB, 26
 - CS080FALB, 26
 - CS080FALBnonsmoker, 27
 - CS080FALBsmoker, 27
 - CS080FANB, 28
 - CS080FANBnonsmoker, 28
 - CS080FANBsmoker, 29
 - CS080MALB, 29
 - CS080MALBnonsmoker, 30
 - CS080MALBsmoker, 30
 - CS080MANB, 31
 - CS080MANBnonsmoker, 31
 - CS080MANBsmoker, 32
 - GAM71F, 35
 - GAM71M, 35
 - GAM83F, 36
 - GAM83M, 36
 - GAM94F, 37
 - GAM94FANB, 37
 - GAM94M, 38
 - GAM94MANB, 38
 - MAYP0206activeF, 40
 - MAYP0206activeM, 40
 - MAYP0206CAF, 41
 - MAYP0206CAM, 41
 - MAYP0206retiredF, 42
 - MAYP0206retiredM, 42
 - Mi06F, 43
 - Mi06M, 43
 - Mi85F, 44
 - Mi85M, 44
 - RV04F, 48
 - RV04M, 49
- a, 4
- A., 5

- aCont, 6
- ACont., 7
- aD, 8
- AD., 9
- af, 10
- am, 11
- Am., 12
- ArgentinaINDEC9092comb, 13
- ArgentinaINDEC9092F, 14
- ArgentinaINDEC9092M, 14
- av, 15
- Av., 16
- avg, 17
- Avg., 19

- CS02001FALBnonsmoker, 20
- CS02001FALBsmoker, 21
- CS02001FANBnonsmoker, 21
- CS02001FANBsmoker, 22
- CS02001MALBnonsmoker, 22
- CS02001MALBsmoker, 23
- CS02001MANBnonsmoker, 23
- CS02001MANBsmoker, 24
- CS058FALB, 24
- CS058FANB, 25
- CS058MALB, 25
- CS058MANB, 26
- CS080FALB, 26
- CS080FALBnonsmoker, 27
- CS080FALBsmoker, 27
- CS080FANB, 28
- CS080FANBnonsmoker, 28
- CS080FANBsmoker, 29
- CS080MALB, 29
- CS080MALBnonsmoker, 30
- CS080MALBsmoker, 30
- CS080MANB, 31
- CS080MANBnonsmoker, 31
- CS080MANBsmoker, 32

- E, 32
- Em, 33

- Fractional_table, 34

- GAM71F, 35
- GAM71M, 35
- GAM83F, 36
- GAM83M, 36

- GAM94F, 37
- GAM94FANB, 37
- GAM94M, 38
- GAM94MANB, 38

- JointSurvival, 39

- Loan_amortization, 39

- MAyP0206activeF, 40
- MAyP0206activeM, 40
- MAyP0206CAF, 41
- MAyP0206CAM, 41
- MAyP0206retiredF, 42
- MAyP0206retiredM, 42
- Mi06F, 43
- Mi06M, 43
- Mi85F, 44
- Mi85M, 44

- Payment_Protection, 45
- PremiumFrac, 46

- qfrac, 47

- Rate_converter, 48
- RV04F, 48
- RV04M, 49

- sf, 49
- Survival, 50

- Table_Dormoy, 50
- Table_Gompertz, 51
- Table_Makeham, 52
- Table_Moivre, 53

- V_a, 53
- V_A., 55
- V_aD, 56
- V_AD., 57
- V_av, 59
- V_Av., 60
- V_avg, 62
- V_Avg., 64
- V_E, 65
- V_Payment_Protection, 66