

# Package ‘DetLifeInsurance’

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**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

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

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

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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 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 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,CSO80MANB,1,"none","none",1)
av(26,2,4,1,0.4,0.04,CSO80MANB,1,"none","none",1)
av(26,1,5,4,0.5,0.04,CSO80MANB,1,"constant","inter",1)
av(24,1,3,3,0.7,0.04,CSO80MANB,1,"constant","intra",1)
av(35,4,6,6,0.4,0.04,CSO80MANB,1,"UDD","inter",1)
av(40,3,7,2,0.7,0.04,CSO80MANB,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,CS080MANB,1,"none","none",1)  
 Avg. (26,2,4,1,0.4,0.04,CS080MANB,1,"none","none",1)  
 Avg. (25,0,15,2,0.25,0.04,CS080MANB,1,"constant","inter",1)  
 Avg. (37,10,10,4,0.05,0.04,CS080MANB,1,"constant","intra",1)  
 Avg. (40,5,20,6,0.04,0.04,CS080MANB,1,"UDD","inter",1)  
 Avg. (20,0,80,12,0.01,0.04,CS080MANB,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>

---

CS058MANB

*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(CS058MANB)`

**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>

---

CS080FALB

*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(CS080FALB)`

**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	<i>de Moivre's Law of Mortality Table Creator</i>
--------------	---

---

**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	<i>Reserve Valuation for Life Annuities</i>
-----	---

---

**Description**

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

**Usage**

```
V_a(  
  px,  
  x,  
  h,  
  n,  
  k = 1,  
  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.
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.
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 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)

```

**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,CSO80MANB,1,"none","none",10000000,4)
V_av(9516712.17583443/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"constant","inter",10000000,48)
V_av(9517.04683383614/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"UDD","inter",10000,48)
V_av(997.404109454868/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"constant","intra",1000,48)
V_av(997436.738989113/12,20,2,2,2,0.05,24,12,0.04,CSO80MANB,1,"UDD","intra",1000000,48)
V_av(28.4421691213902,40,3,7,2,0.7,1,1,0.04,CSO80MANB,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)
```

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