

R Essentials

Other Vector Types

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Agenda

- An overview
- Vector type checking and conversion
- Date
- Datetime: `POSIXct`

An overview

- Vector types in R are able to be converted
- `Date` and `Datetime`: `POSIXct` are all based on UNIX time(a.k.a. POSIX datetime)

Vector type checking and conversion

Using `is.____()` for vector type checking

- `is.numeric()`
- `is.character()`
- `is.logical()`

```
In [1]: is.numeric(87)  
is.character(87)  
is.logical(87)
```

TRUE

FALSE

FALSE

```
In [2]: is.numeric("87")  
is.character("87")  
is.logical("87")
```

FALSE

TRUE

FALSE

```
In [3]: is.numeric(TRUE)  
is.character(TRUE)  
is.logical(TRUE)
```

FALSE

FALSE

TRUE

Using `as.____()` for conversion

- `as.numeric()`
- `as.character()`
- `as.logical()`

```
In [4]: as.character(87)  
as.logical(87)  
as.logical(0)
```

'87'

TRUE

FALSE


```
In [5]: as.numeric("87")  
as.numeric("A")  
as.logical("87")  
as.logical("A")  
as.logical("TRUE")  
as.logical("true")  
as.logical("True")
```

87

Warning message in eval(expr, envir, enclos):
"NAs introduced by coercion"

<NA>

<NA>

<NA>

TRUE

TRUE

TRUE

```
In [6]: as.numeric(TRUE)  
as.numeric(FALSE)  
as.character(TRUE)
```

1

0

'TRUE'

Date

Using `Sys.Date()` for current date

In [7]: `Sys.Date()`

2019-03-11

Mysterious number

```
In [8]: sys_date <- Sys.Date()  
as.numeric(sys_date) # what is this number?
```

17966

Date originates from 1970-01-01

```
In [9]: sys_date - as.numeric(sys_date)
```

```
1970-01-01
```

Every integer stands for a specific date

```
In [10]: original_date <- sys_date - as.numeric(sys_date)
original_date - 1
original_date
original_date + 1
```

1969-12-31

1970-01-01

1970-01-02

Practices: The long last of Beatles

The Beatles were an English rock band formed in Liverpool in 1960. Using `Sys.Date()` and tell us for how many years, this band still gets tremendous popularity.

```
In [11]: beatles_formed <- 1960  
# ...
```


Datetime: POSIXct

Using `Sys.time()` for current datetime

```
In [12]: Sys.time()
```

```
[1] "2019-03-11 10:02:33 CST"
```

Datetime originates from 1970-01-01 08:00:00

```
In [13]: sys_datetime <- Sys.time()  
original_datetime <- sys_datetime - as.numeric(sys_datetime)  
original_datetime
```

```
[1] "1970-01-01 08:00:00 CST"
```

Every integer stands for a specific second

```
In [14]: sys_datetime <- Sys.time()
original_datetime <- sys_datetime - as.numeric(sys_datetime)
original_datetime - 1
original_datetime
original_datetime + 1
```

```
[1] "1970-01-01 07:59:59 CST"
```

```
[1] "1970-01-01 08:00:00 CST"
```

```
[1] "1970-01-01 08:00:01 CST"
```

Using `OlsonNames ()` for specific timezone names

'Africa/Abidjan' 'Africa/Accra' 'Africa/Addis_Ababa' 'Africa/Algiers'
'Africa/Asmara' 'Africa/Asmera' 'Africa/Bamako' 'Africa/Bangui' 'Africa/Banjul'
'Africa/Bissau' 'Africa/Blantyre' 'Africa/Brazzaville' 'Africa/Bujumbura'
'Africa/Cairo' 'Africa/Casablanca' 'Africa/Ceuta' 'Africa/Conakry' 'Africa/Dakar'
'Africa/Dar_es_Salaam' 'Africa/Djibouti' 'Africa/Douala' 'Africa/El_Aaiun'
'Africa/Freetown' 'Africa/Gaborone' 'Africa/Harare' 'Africa/Johannesburg'
'Africa/Juba' 'Africa/Kampala' 'Africa/Khartoum' 'Africa/Kigali' 'Africa/Kinshasa'
'Africa/Lagos' 'Africa/Libreville' 'Africa/Lome' 'Africa/Luanda'
'Africa/Lubumbashi' 'Africa/Lusaka' 'Africa/Malabo' 'Africa/Maputo'
'Africa/Maseru' 'Africa/Mbabane' 'Africa/Mogadishu' 'Africa/Monrovia'
'Africa/Nairobi' 'Africa/Ndjamena' 'Africa/Niamey' 'Africa/Nouakchott'
'Africa/Ouagadougou' 'Africa/Porto-Novo' 'Africa/Sao_Tome' 'Africa/Timbuktu'
'Africa/Tripoli' 'Africa/Tunis' 'Africa/Windhoek' 'America/Adak'
'America/Anchorage' 'America/Anguilla' 'America/Antigua' 'America/Araguaina'
'America/Argentina/Buenos_Aires' 'America/Argentina/Catamarca'
'America/Argentina/ComodRivadavia' 'America/Argentina/Cordoba'
'America/Argentina/Jujuy' 'America/Argentina/La_Rioja'
'America/Argentina/Mendoza' 'America/Argentina/Rio_Gallegos'
'America/Argentina/Salta' 'America/Argentina/San_Juan'
'America/Argentina/San_Luis' 'America/Argentina/Tucuman'
'America/Argentina/Ushuaia' 'America/Aruba' 'America/Asuncion'
'America/Atikokan' 'America/Atka' 'America/Bahia' 'America/Bahia_Banderas'
'America/Barbados' 'America/Belem' 'America/Belize' 'America/Blanc-Sablon'
'America/Boa_Vista' 'America/Bogota' 'America/Boise' 'America/Buenos_Aires'
'America/Cambridge_Bay' 'America/Campo_Grande' 'America/Cancun'

'America/Caracas' 'America/Catamarca' 'America/Cayenne' 'America/Cayman'
'America/Chicago' 'America/Chihuahua' 'America/Coral_Harbour'
'America/Cordoba' 'America/Costa_Rica' 'America/Creston' 'America/Cuiaba'
'America/Curacao' 'America/Danmarkshavn' 'America/Dawson'
'America/Dawson_Creek' 'America/Denver' 'America/Detroit'
'America/Dominica' 'America/Edmonton' 'America/Eirunepe'
'America/El_Salvador' 'America/Ensenada' 'America/Fort_Nelson'
'America/Fort_Wayne' 'America/Fortaleza' 'America/Glace_Bay'
'America/Godthab' 'America/Goose_Bay' 'America/Grand_Turk'
'America/Grenada' 'America/Guadeloupe' 'America/Guatemala'
'America/Guayaquil' 'America/Guyana' 'America/Halifax' 'America/Havana'
'America/Hermosillo' 'America/Indiana/Indianapolis' 'America/Indiana/Knox'
'America/Indiana/Marengo' 'America/Indiana/Petersburg'
'America/Indiana/Tell_City' 'America/Indiana/Vevay'
'America/Indiana/Vincennes' 'America/Indiana/Winamac' 'America/Indianapolis'
'America/Inuvik' 'America/Iqaluit' 'America/Jamaica' 'America/Jujuy'
'America/Juneau' 'America/Kentucky/Louisville' 'America/Kentucky/Monticello'
'America/Knox_IN' 'America/Kralendijk' 'America/La_Paz' 'America/Lima'
'America/Los_Angeles' 'America/Louisville' 'America/Lower_Princes'
'America/Maceio' 'America/Managua' 'America/Manaus' 'America/Marigot'
'America/Martinique' 'America/Matamoros' 'America/Mazatlan'
'America/Mendoza' 'America/Menominee' 'America/Merida'
'America/Metlakatla' 'America/Mexico_City' 'America/Miquelon'
'America/Moncton' 'America/Monterrey' 'America/Montevideo'
'America/Montreal' 'America/Montserrat' 'America/Nassau'
'America/New_York' 'America/Nipigon' 'America/Nome' 'America/Noronha'
'America/North_Dakota/Beulah' 'America/North_Dakota/Center'

'America/North_Dakota/New_Salem' 'America/Ojinaga' 'America/Panama'
'America/Pangnirtung' 'America/Paramaribo' 'America/Phoenix'
'America/Port-au-Prince' 'America/Port_of_Spain' 'America/Porto_Acre'
'America/Porto_Velho' 'America/Puerto_Rico' 'America/Punta_Arenas'
'America/Rainy_River' 'America/Rankin_Inlet' 'America/Recife' 'America/Regina'
'America/Resolute' 'America/Rio_Branco' 'America/Rosario'
'America/Santa_Isabel' 'America/Santarem' 'America/Santiago'
'America/Santo_Domingo' 'America/Sao_Paulo' 'America/Scoresbysund'
'America/Shiprock' 'America/Sitka' 'America/St_Barthelemy' 'America/St_Johns'
'America/St_Kitts' 'America/St_Lucia' 'America/St_Thomas' 'America/St_Vincent'
'America/Swift_Current' 'America/Tegucigalpa' 'America/Thule'
'America/Thunder_Bay' 'America/Tijuana' 'America/Toronto' 'America/Tortola'
'America/Vancouver' 'America/Virgin' 'America/Whitehorse'
'America/Winnipeg' 'America/Yakutat' 'America/Yellowknife' 'Antarctica/Casey'
'Antarctica/Davis' 'Antarctica/DumontDURville' 'Antarctica/Macquarie'
'Antarctica/Mawson' 'Antarctica/McMurdo' 'Antarctica/Palmer'
'Antarctica/Rothera' 'Antarctica/South_Pole' 'Antarctica/Syowa'
'Antarctica/Troll' 'Antarctica/Vostok' 'Arctic/Longyearbyen' 'Asia/Aden'
'Asia/Almaty' 'Asia/Amman' 'Asia/Anadyr' 'Asia/Aqtau' 'Asia/Aqtobe'
'Asia/Ashgabat' 'Asia/Ashkhabad' 'Asia/Atyrau' 'Asia/Baghdad' 'Asia/Bahrain'
'Asia/Baku' 'Asia/Bangkok' 'Asia/Barnaul' 'Asia/Beirut' 'Asia/Bishkek'
'Asia/Brunei' 'Asia/Calcutta' 'Asia/Chita' 'Asia/Choibalsan' 'Asia/Chongqing'
'Asia/Chungking' 'Asia/Colombo' 'Asia/Dacca' 'Asia/Damascus' 'Asia/Dhaka'
'Asia/Dili' 'Asia/Dubai' 'Asia/Dushanbe' 'Asia/Famagusta' 'Asia/Gaza'
'Asia/Harbin' 'Asia/Hebron' 'Asia/Ho_Chi_Minh' 'Asia/Hong_Kong' 'Asia/Hovd'
'Asia/Irkutsk' 'Asia/Istanbul' 'Asia/Jakarta' 'Asia/Jayapura' 'Asia/Jerusalem'
'Asia/Kabul' 'Asia/Kamchatka' 'Asia/Karachi' 'Asia/Kashgar' 'Asia/Kathmandu'

'Asia/Katmandu' 'Asia/Khandyga' 'Asia/Kolkata' 'Asia/Krasnoyarsk'
'Asia/Kuala_Lumpur' 'Asia/Kuching' 'Asia/Kuwait' 'Asia/Macao' 'Asia/Macau'
'Asia/Magadan' 'Asia/Makassar' 'Asia/Manila' 'Asia/Muscat' 'Asia/Nicosia'
'Asia/Novokuznetsk' 'Asia/Novosibirsk' 'Asia/Omsk' 'Asia/Oral'
'Asia/Phnom_Penh' 'Asia/Pontianak' 'Asia/Pyongyang' 'Asia/Qatar'
'Asia/Qyzylorda' 'Asia/Rangoon' 'Asia/Riyadh' 'Asia/Saigon' 'Asia/Sakhalin'
'Asia/Samarkand' 'Asia/Seoul' 'Asia/Shanghai' 'Asia/Singapore'
'Asia/Srednekolymsk' 'Asia/Taipei' 'Asia/Tashkent' 'Asia/Tbilisi' 'Asia/Tehran'
'Asia/Tel_Aviv' 'Asia/Thimbu' 'Asia/Thimphu' 'Asia/Tokyo' 'Asia/Tomsk'
'Asia/Ujung_Pandang' 'Asia/Ulaanbaatar' 'Asia/Ulan_Bator' 'Asia/Urumqi'
'Asia/Ust-Nera' 'Asia/Vientiane' 'Asia/Vladivostok' 'Asia/Yakutsk' 'Asia/Yangon'
'Asia/Yekaterinburg' 'Asia/Yerevan' 'Atlantic/Azores' 'Atlantic/Bermuda'
'Atlantic/Canary' 'Atlantic/Cape_Verde' 'Atlantic/Faeroe' 'Atlantic/Faroe'
'Atlantic/Jan_Mayen' 'Atlantic/Madeira' 'Atlantic/Reykjavik'
'Atlantic/South_Georgia' 'Atlantic/St_Helena' 'Atlantic/Stanley' 'Australia/ACT'
'Australia/Adelaide' 'Australia/Brisbane' 'Australia/Broken_Hill'
'Australia/Canberra' 'Australia/Currie' 'Australia/Darwin' 'Australia/Eucla'
'Australia/Hobart' 'Australia/LHI' 'Australia/Lindeman' 'Australia/Lord_Howe'
'Australia/Melbourne' 'Australia/NSW' 'Australia/North' 'Australia/Perth'
'Australia/Queensland' 'Australia/South' 'Australia/Sydney' 'Australia/Tasmania'
'Australia/Victoria' 'Australia/West' 'Australia/Yancowinna' 'Brazil/Acre'
'Brazil/DeNoronha' 'Brazil/East' 'Brazil/West' 'CET' 'CST6CDT'
'Canada/Atlantic' 'Canada/Central' 'Canada/Eastern' 'Canada/Mountain'
'Canada/Newfoundland' 'Canada/Pacific' 'Canada/Saskatchewan'
'Canada/Yukon' 'Chile/Continental' 'Chile/EasterIsland' 'Cuba' 'EET' 'EST'
'EST5EDT' 'Egypt' 'Eire' 'Etc/GMT' 'Etc/GMT+0' 'Etc/GMT+1' 'Etc/GMT+10'
'Etc/GMT+11' 'Etc/GMT+12' 'Etc/GMT+2' 'Etc/GMT+3' 'Etc/GMT+4'

'Etc/GMT+11' 'Etc/GMT+12' 'Etc/GMT+13' 'Etc/GMT+14' 'Etc/GMT+15' 'Etc/GMT+16' 'Etc/GMT+17' 'Etc/GMT+18' 'Etc/GMT+19' 'Etc/GMT+20' 'Etc/GMT+21' 'Etc/GMT+22' 'Etc/GMT+23' 'Etc/GMT+24' 'Etc/GMT+25' 'Etc/GMT+26' 'Etc/GMT+27' 'Etc/GMT+28' 'Etc/GMT+29' 'Etc/GMT+30' 'Etc/GMT-0' 'Etc/GMT-1' 'Etc/GMT-10' 'Etc/GMT-11' 'Etc/GMT-12' 'Etc/GMT-13' 'Etc/GMT-14' 'Etc/GMT-2' 'Etc/GMT-3' 'Etc/GMT-4' 'Etc/GMT-5' 'Etc/GMT-6' 'Etc/GMT-7' 'Etc/GMT-8' 'Etc/GMT-9' 'Etc/GMT0' 'Etc/Greenwich' 'Etc/UCT' 'Etc/UTC' 'Etc/Universal' 'Etc/Zulu' 'Europe/Amsterdam' 'Europe/Andorra' 'Europe/Astrakhan' 'Europe/Athens' 'Europe/Belfast' 'Europe/Belgrade' 'Europe/Berlin' 'Europe/Bratislava' 'Europe/Brussels' 'Europe/Bucharest' 'Europe/Budapest' 'Europe/Busingen' 'Europe/Chisinau' 'Europe/Copenhagen' 'Europe/Dublin' 'Europe/Gibraltar' 'Europe/Guernsey' 'Europe/Helsinki' 'Europe/Isle_of_Man' 'Europe/Istanbul' 'Europe/Jersey' 'Europe/Kaliningrad' 'Europe/Kiev' 'Europe/Kirov' 'Europe/Lisbon' 'Europe/Ljubljana' 'Europe/London' 'Europe/Luxembourg' 'Europe/Madrid' 'Europe/Malta' 'Europe/Mariehamn' 'Europe/Minsk' 'Europe/Monaco' 'Europe/Moscow' 'Europe/Nicosia' 'Europe/Oslo' 'Europe/Paris' 'Europe/Podgorica' 'Europe/Prague' 'Europe/Riga' 'Europe/Rome' 'Europe/Samara' 'Europe/San_Marino' 'Europe/Sarajevo' 'Europe/Saratov' 'Europe/Simferopol' 'Europe/Skopje' 'Europe/Sofia' 'Europe/Stockholm' 'Europe/Tallinn' 'Europe/Tirane' 'Europe/Tiraspol' 'Europe/Ulyanovsk' 'Europe/Uzhgorod' 'Europe/Vaduz' 'Europe/Vatican' 'Europe/Vienna' 'Europe/Vilnius' 'Europe/Volgograd' 'Europe/Warsaw' 'Europe/Zagreb' 'Europe/Zaporozhye' 'Europe/Zurich' 'GB' 'GB-Eire' 'GMT' 'GMT+0' 'GMT-0' 'GMT0' 'Greenwich' 'HST' 'Hongkong' 'Iceland' 'Indian/Antananarivo' 'Indian/Chagos' 'Indian/Christmas' 'Indian/Cocos' 'Indian/Comoro' 'Indian/Kerguelen' 'Indian/Mahe' 'Indian/Maldives' 'Indian/Mauritius' 'Indian/Mayotte' 'Indian/Reunion' 'Iran' 'Israel' 'Jamaica' 'Japan' 'Kwajalein' 'Libya' 'MET' 'MST' 'MST7MDT' 'Mexico/BajaNorte' 'Mexico/BajaSur' 'Mexico/General' 'NZ' 'NZ-CHAT' 'Nayagio' 'PRC' 'PST8PDT'

Practices: The 921 earthquake

"1999-09-21 01:47:16" the Jiji earthquake occurred in Nantou, Taiwan with a Richter scale of 7.3. The first major after-shock occurred on "1999-09-21 01:57:15". Let us know how long was it between these two shocks.

```
In [16]: first_shock <- "1999-09-21 01:47:16"  
        after_shock <- "1999-09-21 01:57:15"
```