Simulation of a harbour port

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problem Statment

A harbour port has three berths 1, 2 and 3. At any given time Berth1 can accommodate two small ships, or one medium ship. Berth2 and Berth3 can each handle one large ship, two medium ships or four small ships.

The interarrival time of ships is 26 hours, exponentially distributed, and small, medium, and large ships are in the proportions 5:3:2 respectively. Queuing for berths is on a first come first served basis, except that no medium or small ship may go to a berth for which a large ship is waiting, and medium ships have a higher priority than small ships.

Unloading times for ships are exponentially distributed with mean times as follows: small ships, 15 hours; medium ships, 30 hours; and large ships, 45 hours.

The loading times are as follows: - Small ships: 24 ± 6 hours uniformly distributed. - Medium ships: 36 ± 10 hours uniformly distributed. - Large ships: 56 ± 12 hours uniformly distributed.

The tide must be high for large ships to enter or leave Berths 2 and 3. Low tide lasts 3 hours, high tide, 10 hours.

Write a R program to simulate the harbour port and 1. run the simulation for 500 days, 2. determine the distribution of transit times of each type of ship 3. determine the utilization of the three berths.

Code

```
library(simmer)
library(simmer.plot)
library(ggplot2)
```

variables and Config.

```
# setup
set.seed(42)

# create Simulation Envirenment
env <- simmer()
```

```
SIM_TIME <- 24*500    # Simulation time in minutes
```

```
ship_attrs <- function(){
  # get ship type as per 5:3:2=small:medium:big
  # determine ship type, 1 = small, 2= medium, 3 = big
  ship_type = sample(1:3,size=1, prob = c((5/10), (3/10), (2/10)))
  # randmly select berth to go
  # berth, 1 == berth1, 2 == berth2, 3 == berth3
```

```
  berth = "berth3"
  quan = 0
  unload_time = 0
  load_time = 0
  a = c("berth1", "berth2", "berth3")
  b = c("berth2", "berth3")

  if (ship_type == 1 ){
        berth = sample(a, size=1)
        quan = 1
        unload_time = rexp(1, 15)
        load_time = runif(1, 18, 30)
  }
    if (ship_type == 2 ){
        berth = sample(a, size=1)
        quan = 2
        unload_time = rexp(1, 30)
        load_time = runif(1, 26, 46)
    }
    if (ship_type == 3 ){
        berth = sample(b, size=1)
        quan = 4
        unload_time = rexp(1, 45)
        load_time = runif(1, 44, 68)
    }
  return(c(berth, quan, load_time, unload_time, ship_type))
}
```

```
# This chunk is reponsible for crash
ship <- trajectory() %>%
  log_("arrives at the port") %>%
  set_attribute("dat", ship_attrs()) %>%
  log_(attr["dat"]) %>%
  set_prioritization(attr["dat"][5]) %>%

  seize(attr["dat"][1], attr["dat"][2] ) %>%
  timeout(floor(attr["dat"][4])) %>%
  timeout(floor(attr["dat"][3])) %>%
  release(attr["dat"][1], attr["dat"][2]) %>%
  log_("leaves the port")
```

```
env %>%
    # add resources
    # berth1 resource is 2 // 1 medium ship == 2 small
    add_resource("berth1", 2) %>%
    # berth2 resource is 4 // 1 big ship == 2 medium == 4 small
    add_resource("berth2", 4) %>%
    # berth3 resource is 4 // 1 big ship == 2 medium == 4 small
    add_resource("berth3", 4) %>%
    # add ship generator with exponetial distribution
    add_generator("ship", ship, function() rexp(1, 1/26) ) %>%
    # start the simulation
    run(SIM_TIME)
```

output

This code is resulting in a crash of R studio.

Plot Things

```
plot(env, what = "resources", metric = "usage", c("berth1", "berth2", "berth3"))
plot(env, what = "resources", metric = "utilization", c("berth1", "berth2", "berth3"))
plot(env, what = "arrivals", metric = "activity_time")
plot(env, what = "arrivals", metric = "waiting_time")
plot(env, what = "arrivals", metric = "flow_time")
```

Conclusion

In this assignment I used discrete-event simulation library simmer to create a simulation, I was unsucessfull in creating a full simulation as per problem statment but

I was able to create some other simple simulations which can be found on my github account (https://github.com/electron0zero/R-projects/tree/master/hospital_simulation)