

3.

Exercise 10 (Steelwork Mining and Metal)

Probability distribution, simulations

SteelworkChina is a company operating in a Chinese port. The port facility consists in a wharf able to load or unload two 50.000 tons ore carriers at the same time. Each loading / unloading operation lasts one day. The wharf facility is available 24 hours a day and 7 days a week.

Today's number of cargo ships coming to SteelworkChina facilities is 250 per year. But this should increase within 2 years to 500 ships per year. Each ship should be loaded/unloaded the day of its arrival and SteelworkChina is subject to €7000 penalties per day for late completion.

In order to avoid substantial penalties, two projects are under review:

- Expansion of the existing wharf, which should enable to load 3 ships at the same time. The investment cost is €3 000 000, amortized over 6 years.
- Construction of a second wharf, which will double the capacity (4 ships). The investment cost is €7 500 000, amortized over 6 years.

Statistical surveys seem to indicate that the number of ships arriving each day is best approximated using a Poisson distribution.

Questions

1. Ships arrivals for 365 days have been computed using a Poisson law (Expected value 500/year). Calculate the average cost (e.g. penalties + annual depreciation charge) of each solution (status quo, expansion, second wharf) for one year, assuming 500 ships are expected
2. Test these results for different numbers of incoming ships (from 350 to 800 by steps of 50).