Calculate Reliability

Chandresh Lokesha

Spring 24

Question 1

An analytics group has built a distributed data lake as part of a new data warehouse. The data warehouse consists of a number of distinct components, including:

- A database on a cloud server (99.987% availability)
- Two identical database management system servers (99.3%)
- An analytics logic server (94.7%)
- Network infrastructure to the cloud server (98.37%)

What is the overall availability of the system, expressed as a percentage with three digits of precision? Show your work.

Solution:

The overall availability of the system can be calculated using the formula for parallel systems:

$$A_{\text{overall}} = \prod_{i=1}^{n}(A_i)$$

where A_i represents the availability of each component.

Given:

- Cloud server availability $(A_1) = 99.987\%$
- Database management system servers availability $(A_2) = 99.3\%$
- Analytics logic server availability $(A_3) = 94.7\%$
- Network infrastructure availability $(A_4) = 98.37\%$

We can calculate the overall availability:

```
cloud_server <- 0.99987
db_servers <- 0.993
analytics_server <- 0.947
network_infrastructure <- 0.9837

overall_availability <- cloud_server * db_servers * analytics_server * network_infrastructure
overall_availability_percentage <- overall_availability * 100
round(overall_availability_percentage, 3)
```

```
## [1] 92.492
```

Question 2

Solution:

The expected annual reliability of the RAID 1+0 storage system can be calculated using the formula:

$$\text{Reliability} = e^{-\frac{\text{hours}}{\text{MBTF}}}$$

Given:

- MBTF = 1,450,000 hours

We can calculate the expected annual reliability:

```
MBTF <- 1450000
hours_per_year <- 24 * 365

reliability <- exp(-hours_per_year / MBTF)
reliability
```

```
## [1] 0.9939768
```