

CA266- Probability & Statistics Resit Assignment

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Information about the system: reliability_probabilities <- c(.97, .68, .89, .93)
num_of_components_in_parallel <- c(1, 5, 3, 2)

Part A

```
function(num_of_components_in_parallel, reliability_probabilities)
{
  i <- 0
  total = 1
  while (i < length(reliability_probabilities))
  {
    i = i + 1
    total = total * (1 - (1-reliability_probabilities[i])^num_of_components_in_parallel[i])
  }
  return(total)
}
```

```
System_rel <- function(num_of_components_in_parallel, reliability_probabilities)
{
  i <- 0
  total = 1
  while (i < length(reliability_probabilities))
  {
    i = i + 1
    total = total * (1 - (1-reliability_probabilities[i])^num_of_components_in_parallel[i])
  }
  return(total)
}
```

Result

```
> sprintf("Probability of system working = %f", calc_system_reliability(num_of_components_in_parallel, reliability_probabilities))
[1] "Probability of system working = 0.960728"
```

```
sprintf("Probability of system working = %f",
calc_system_reliability(num_of_components_in_parallel, reliability_probabilities))
```

```
[1] "Probability of system working = 0.960728"
```

Part B

```
function(num, reliability_probabilities, num_of_components_in_parallel){
|   total <- 0

  for (i in 1:num){
    count <- 0

    for (a in 1:length(num_of_components_in_parallel)){
      temp_count <- 0

      for (j in 1: num_of_components_in_parallel [a]){
        if (runif(1) <= reliability_probabilities [a]){
          temp_count <- 1
          break
        }
      }
      if (temp_count == 1){
        count <- count + 1
      }
    }
    if (count == length(reliability_probabilities)){
      total <- total + 1
    }
  }
  system_reliability_probability <- total / num
  return(system_reliability_probability)
}
```

num <- 100

```
system_function <- function(num, reliability_probabilities, num_of_components_in_parallel){
  total <- 0
  for (i in 1:num){
    count <- 0
    for (a in 1:length(num_of_components_in_parallel)){
      temp_count <- 0
      for (j in 1: num_of_components_in_parallel [a]){
        if (runif(1) <= reliability_probabilities [a]){
          temp_count <- 1
          break
        }
      }
      if (temp_count == 1){
        count <- count + 1
      }
    }
    if (count == length(reliability_probabilities)){
      total <- total + 1
    }
  }
  system_reliability_probability <- total / num
  return(system_reliability_probability)
}
```

100 iterations results

```
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities, num_of_components_in_parallel))
[1] "result after 100 iterations: 0.950000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities, num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities, num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities, num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities, num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities, num_of_components_in_parallel))
[1] "result after 100 iterations: 0.970000"
```

```
sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities,
num_of_components_in_parallel))
[1] "result after 100 iterations: 0.950000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities,
num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities,
num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities,
num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities,
num_of_components_in_parallel))
[1] "result after 100 iterations: 0.960000"
> sprintf("result after 100 iterations: %f", system_function(num, reliability_probabilities,
num_of_components_in_parallel))
[1] "result after 100 iterations: 0.970000"
>
```

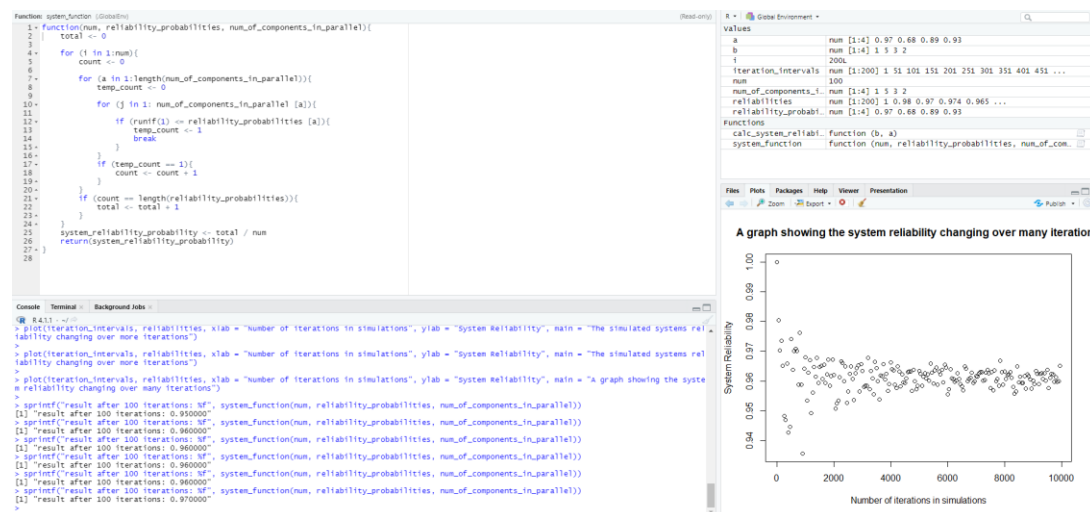
Part C

```
iteration_intervals <- seq(1, 10000, 50)
reliabilities <- c(0)
```

```
for (i in 1:length(iteration_intervals)){
  reliabilities[i] <- system_function(iteration_intervals[i], reliability_probabilities,
num_of_components_in_parallel)
}
```

Plotting

Plot(iteration_intervals, reliabilities, xlab = "Number of iterations in simulations", ylab = "System Reliability", main = "The simulated systems reliability changing over more iterations")



A graph showing the system reliability changing over many iteration

