Applied Discrete Modelling

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Assignment- 6

**System Specification**

A cell tester’s behavior is described by the above HnMM.

**Implementation**

Extend your hard coded Proxel program with symbol outputs and path tracking

**Tasks and Questions**

Construct the state space and RG of the above model, including symbol emissions.

Write down the formal description of the above HnMM.

Use your program to answer the following questions:

* What is the probability of the given output sequence?
* What are the 5 most likely generating paths of that sequence?
* How many defective wafers were produced by each source according to these paths?
* What is the average defect probability of each source, over all relevant generating paths?

We have further test protocols from different days (2-5) representing observations of wafers from

the same sources.

* Use these traces to refine your estimate of the actual defect probability of each source.

**Formal description of HnMM:**

The above mentioned HnMM has one state and two firing transitions (Source 0, Source 1) from it. Both of the transitions are in “Race Age” condition which means that their execution is independent of each other. At each time step a product is evaluated by the quality tester and classified as “OK” or “Defective” with a probability of 0.95 and 0.05, respectively. We are aware of the generated product being “OK” or “Defective” but the source of product (responsible transition, generating the product) is hidden to us. The firing time for both the machine is also random and so an underlying pattern cannot be calculated. At each time step we assume separate conditions of each transition being fired and calculate individual probabilities for both Source 0 and Source 1. We build a binary tree for the length of time steps provided in the protocol files. All the calculations are performed on the generated binary tree of the HnMM.

**Task 01:** What is the probability of the given output sequence?

Sol: -4.011437634e3

**Task 02:** What are the 5 most likely generating paths of that sequence?

Sol: The top 5 paths are provided in the output file attached with assignment.

**Task 03:** How many defective wafers were produced by each source according to these paths?

Sol:

|  |  |  |
| --- | --- | --- |
|  | SOURCE 0 | SOURCE 1 |
| Path 1 | 0/13 | 13/13 |
| Path 2 | 0/13 | 13/13 |
| Path 3 | 13/13 | 0/13 |
| Path 4 | 13/13 | 0/13 |
| Path 5 | 0/13 | 13/13 |
| Path 6 | 0/13 | 13/13 |
| Path 7 | 0/13 | 13/13 |
| Path 8 | 0/13 | 13/13 |
| Path 9 | 0/13 | 13/13 |
| Path 10 | 13/13 | 0/13 |

**Task 04:** What is the average defect probability of each source, over all relevant generating paths?

Sol:

|  |  |  |
| --- | --- | --- |
|  | SOURCE 0 | SOURCE 1 |
| Av. Probability | 0.02 | 0.06 |