

**UNIVERSIDAD DE CUENCA**

**COMPUTACIÓN**

**TRABAJO #1**

**Asignatura:** Teoría de la Computación

**Docente:** Ing. Elina Ávila

**Integrantes:**

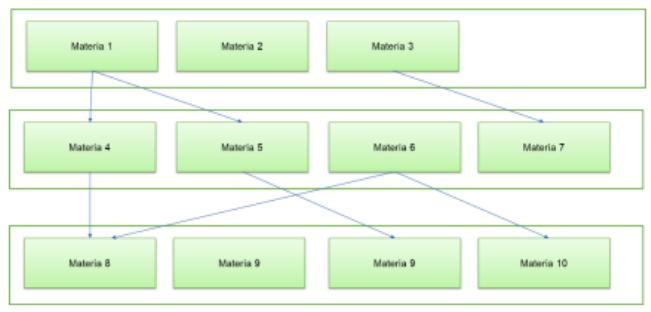
Ronny Montenegro, Marcos Naranjo y Bryan Mendoza

**Fecha:** 11/10/2022

**TRABAJO #1**

**Ejercicio 1**

Asuma que debe construir un AFD para verificar el cumplimiento de una malla académica. Un estudiante inscrito en esa malla, deberá aprobar todos los cursos para lograr titularse. Cuando termina la carrera, el profesor fiscal, revisará que las materias se hayan aprobado en el orden correcto, esto es, sin haberse saltado un prerrequisito. Si esto es así, entonces el estudiante obtendrá la aprobación para graduarse, caso contrario tendrá que acogerse a un proceso de regularización, lo que le impide graduarse. En la imagen siguiente se ilustra las materias por nivel y sus encadenamientos. Note que para tomar la Materia 8, tuvo que haber aprobado previamente las materias 4 y 6.



Diseñe un AFD para validar la secuencia de aprobación de materias de un estudiante conforme la imagen. Decida qué símbolos tendrá su alfabeto y qué significarán en el contexto. Cree la definición formal de su AFD y constrúyalo con automaton simulator.

**1. Un párrafo de no más de 10 líneas explicando cómo solucionaron su problema y qué significado tienen los símbolos de su alfabeto, qué tipo de cadenas se esperan, etc.**

Empezamos determinando cuales son las materias que se pueden tomar sin requisitos previos y cuales no se pueden tomar, las materias que necesitan requisitos se irán directamente a un estado de desecho, mientras que las que se pueden tomar avanzan a un estado nuevo donde se analizarán cuales son las materias que se podrán tomar ahora habiendo aprobado las primeras materias, de este nuevo estado solamente se podrá salir con una nueva materia que ya haya cumplido su prerrequisito e irán a un nuevo estado; nuevamente, las materias que aún no tengan sus prerrequisitos cumplidos irán al estado de desecho. Se repite este proceso hasta que se llega al estado de “graduación” con las últimas materias que necesitaban prerrequisitos.

Los símbolos de nuestro alfabeto (1, 2, 3, 4, 5, 6, 7, 8, 9, A, B) representan las materias correspondientes de la malla. Se esperan que se acepten las cadenas que contengan las últimas materias que se necesitan para graduarse y que estén después de sus respectivos prerrequisitos, caso contrario la cadena deberá ser rechazada.

**2. 5 ejemplos de cadenas aceptadas y 5 ejemplos de cadenas rechazadas**

|  |  |
| --- | --- |
| **Aceptadas** | **Rechazadas** |
| 123456789AB | 4589 |
| 1458A | 12A78 |
| 379 | A87654321 |
| 268A | 738A |
| 145768 | 124538 |

**3. Un cuadro en el que se indique que significan cada uno de los estados del AFD, desde la perspectiva del problema. Por ejemplo: estado 4, es un estado de rechazo donde van las cadenas que contienen materias aprobadas sin prerrequisitos**

|  |  |
| --- | --- |
| **Estado** | **Significado** |
| start | Estado inicial del automata, en este punto no se ha tomado ninguna materia |
| S0 | Primer estado al que se llega con las materias que no necesitan prerrequitos |
| S2 | Estado en el que se encuentran las primeras materias con prerrequisitos, solo se puede llegar aquí habiendo pasada por el estado s0 |
| Graduación | Estado al cual solo se puede llegar con las últimas materias de la malla que necesitan más prerrequisitos |
| Desecho | Estado donde terminan todas las materias que no han cumplido su prerrequisito. |

**4. El plaintext del automaton simulato**r

{"type":"DFA","dfa":{"transitions":{"start":{"1":"s0","2":"s0","3":"s0","4":"s4","5":"s4","6":"s0","7":"s4","8":"s4","9":"s0","A":"s4"},"s0":{"1":"s0","2":"s0","3":"s0","4":"s2","5":"s2","6":"s2","7":"s2","8":"s4","9":"s0","A":"s4"},"s2":{"1":"s4","2":"s4","3":"s4","4":"s2","5":"s2","6":"s2","7":"s2","8":"s3","9":"s3","A":"s3"},"s3":{"1":"s4","2":"s4","3":"s4","4":"s4","5":"s4","6":"s4","8":"s3","9":"s3","A":"s3","B":"s3"},"s4":{"1":"s4","2":"s4","3":"s4","4":"s4","5":"s4","6":"s4","7":"s4","8":"s4","9":"s4","A":"s4"}},"startState":"start","acceptStates":["s3"]},"states":{"start":{},"s0":{"top":90,"left":248,"displayId":"s0"},"s4":{"top":406,"left":335,"displayId":"Desecho"},"s2":{"top":169,"left":553,"displayId":"s2"},"s3":{"isAccept":true,"top":296,"left":816,"displayId":"Graduación"}},"transitions":[{"stateA":"start","label":"1","stateB":"s0"},{"stateA":"start","label":"2","stateB":"s0"},{"stateA":"start","label":"3","stateB":"s0"},{"stateA":"start","label":"4","stateB":"s4"},{"stateA":"start","label":"5","stateB":"s4"},{"stateA":"start","label":"6","stateB":"s0"},{"stateA":"start","label":"7","stateB":"s4"},{"stateA":"start","label":"8","stateB":"s4"},{"stateA":"start","label":"9","stateB":"s0"},{"stateA":"start","label":"A","stateB":"s4"},{"stateA":"s0","label":"1","stateB":"s0"},{"stateA":"s0","label":"2","stateB":"s0"},{"stateA":"s0","label":"3","stateB":"s0"},{"stateA":"s0","label":"4","stateB":"s2"},{"stateA":"s0","label":"5","stateB":"s2"},{"stateA":"s0","label":"6","stateB":"s2"},{"stateA":"s0","label":"7","stateB":"s2"},{"stateA":"s0","label":"8","stateB":"s4"},{"stateA":"s0","label":"9","stateB":"s0"},{"stateA":"s0","label":"A","stateB":"s4"},{"stateA":"s2","label":"1","stateB":"s4"},{"stateA":"s2","label":"2","stateB":"s4"},{"stateA":"s2","label":"3","stateB":"s4"},{"stateA":"s2","label":"4","stateB":"s2"},{"stateA":"s2","label":"5","stateB":"s2"},{"stateA":"s2","label":"6","stateB":"s2"},{"stateA":"s2","label":"7","stateB":"s2"},{"stateA":"s2","label":"8","stateB":"s3"},{"stateA":"s2","label":"9","stateB":"s3"},{"stateA":"s2","label":"A","stateB":"s3"},{"stateA":"s3","label":"1","stateB":"s4"},{"stateA":"s3","label":"2","stateB":"s4"},{"stateA":"s3","label":"3","stateB":"s4"},{"stateA":"s3","label":"4","stateB":"s4"},{"stateA":"s3","label":"5","stateB":"s4"},{"stateA":"s3","label":"6","stateB":"s4"},{"stateA":"s3","label":"8","stateB":"s3"},{"stateA":"s3","label":"9","stateB":"s3"},{"stateA":"s3","label":"A","stateB":"s3"},{"stateA":"s3","label":"B","stateB":"s3"},{"stateA":"s4","label":"1","stateB":"s4"},{"stateA":"s4","label":"2","stateB":"s4"},{"stateA":"s4","label":"3","stateB":"s4"},{"stateA":"s4","label":"4","stateB":"s4"},{"stateA":"s4","label":"5","stateB":"s4"},{"stateA":"s4","label":"6","stateB":"s4"},{"stateA":"s4","label":"7","stateB":"s4"},{"stateA":"s4","label":"8","stateB":"s4"},{"stateA":"s4","label":"9","stateB":"s4"},{"stateA":"s4","label":"A","stateB":"s4"}],"bulkTests":{"accept":"123456789AB\n1458A\n379\n268A\n145768","reject":"4589\n12A78\nA87654321\n738A\n124538"}}

**5. La definición formal.**

**Q=** {start, s0, s2, Graduación, Desecho}

**Σ=** {1,2,3,4,5,6,7,8,9, A, B}

**δ=**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Q/** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **A** | **B** |
| **\*Start** | s0 | s0 | s0 | Desecho | Desecho | s0 | Desecho | Desecho | s0 | Desecho | Desecho |
| **s0** | s0 | s0 | s0 | s2 | s2 | s0 | s2 | Desecho | s0 | Desecho | Desecho |
| **s2** | Desecho | Desecho | Desecho | s2 | s2 | s2 | s2 | Graduación | s2 | Graduación | Graduación |
| **\*Graduación** | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Graduación | Graduación | Graduación | Graduación |
| **Desecho** | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho | Desecho |

**q0=** start

**F= {**graduación}

**Ejercicio 2**

Asuma que el AFD M2 tiene un alfabeto: {0,1,2}. A este autómata se le envían cadenas, pero solo serán aceptadas aquellas cuyos 2 primeros símbolos sumen como mucho 2 y sus 2 últimos símbolos sumen como mucho 1. Las demás serán rechazadas. Cadenas válidas son: 00210, 111,02200. Cadenas inválidas: 0, 221,122. Las cadenas no tienen un límite de longitud.

Emplee automaton simulator para generar la solución. Copie la URL y el plaintext en el documento.

**URL:**

[http://automatonsimulator.com/#%7B%22type%22%3A%22DFA%22%2C%22dfa%22%3A%7B%22transitions%22%3A%7B%22start%22%3A%7B%220%22%3A%22s0%22%2C%221%22%3A%22s1%22%2C%222%22%3A%22s2%22%7D%2C%22s0%22%3A%7B%220%22%3A%22s5%22%2C%221%22%3A%22s4%22%2C%222%22%3A%22s8%22%7D%2C%22s1%22%3A%7B%220%22%3A%22s5%22%2C%221%22%3A%22s7%22%2C%222%22%3A%22s6%22%7D%2C%22s2%22%3A%7B%220%22%3A%22s0%22%2C%221%22%3A%22s6%22%2C%222%22%3A%22s6%22%7D%2C%22s6%22%3A%7B%220%22%3A%22s6%22%2C%221%22%3A%22s6%22%2C%222%22%3A%22s6%22%7D%2C%22s4%22%3A%7B%220%22%3A%22s5%22%2C%221%22%3A%22s7%22%2C%222%22%3A%22s8%22%7D%2C%22s5%22%3A%7B%220%22%3A%22s5%22%2C%221%22%3A%22s4%22%2C%222%22%3A%22s8%22%7D%2C%22s7%22%3A%7B%220%22%3A%22s5%22%2C%221%22%3A%22s7%22%2C%222%22%3A%22s8%22%7D%2C%22s8%22%3A%7B%220%22%3A%22s0%22%2C%221%22%3A%22s7%22%2C%222%22%3A%22s8%22%7D%7D%2C%22startState%22%3A%22start%22%2C%22acceptStates%22%3A%5B%22s5%22%2C%22s4%22%5D%7D%2C%22states%22%3A%7B%22start%22%3A%7B%7D%2C%22s0%22%3A%7B%22top%22%3A68%2C%22left%22%3A0%2C%22displayId%22%3A%22s0%22%7D%2C%22s1%22%3A%7B%22top%22%3A277%2C%22left%22%3A325%2C%22displayId%22%3A%22s1%22%7D%2C%22s2%22%3A%7B%22top%22%3A303%2C%22left%22%3A97%2C%22displayId%22%3A%22s2%22%7D%2C%22s5%22%3A%7B%22isAccept%22%3Atrue%2C%22top%22%3A255%2C%22left%22%3A726%2C%22displayId%22%3A%22s4%22%7D%2C%22s4%22%3A%7B%22isAccept%22%3Atrue%2C%22top%22%3A142%2C%22left%22%3A141%2C%22displayId%22%3A%22s3%22%7D%2C%22s8%22%3A%7B%22top%22%3A35%2C%22left%22%3A380%2C%22displayId%22%3A%22s7%22%7D%2C%22s7%22%3A%7B%22top%22%3A73%2C%22left%22%3A797%2C%22displayId%22%3A%22s6%22%7D%2C%22s6%22%3A%7B%22top%22%3A510%2C%22left%22%3A113%2C%22displayId%22%3A%22s5%22%7D%7D%2C%22transitions%22%3A%5B%7B%22stateA%22%3A%22start%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s0%22%7D%2C%7B%22stateA%22%3A%22start%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s1%22%7D%2C%7B%22stateA%22%3A%22start%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s2%22%7D%2C%7B%22stateA%22%3A%22s0%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s5%22%7D%2C%7B%22stateA%22%3A%22s0%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s4%22%7D%2C%7B%22stateA%22%3A%22s0%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s8%22%7D%2C%7B%22stateA%22%3A%22s1%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s5%22%7D%2C%7B%22stateA%22%3A%22s1%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s7%22%7D%2C%7B%22stateA%22%3A%22s1%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s6%22%7D%2C%7B%22stateA%22%3A%22s2%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s0%22%7D%2C%7B%22stateA%22%3A%22s2%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s6%22%7D%2C%7B%22stateA%22%3A%22s2%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s6%22%7D%2C%7B%22stateA%22%3A%22s6%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s6%22%7D%2C%7B%22stateA%22%3A%22s6%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s6%22%7D%2C%7B%22stateA%22%3A%22s6%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s6%22%7D%2C%7B%22stateA%22%3A%22s4%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s5%22%7D%2C%7B%22stateA%22%3A%22s4%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s7%22%7D%2C%7B%22stateA%22%3A%22s4%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s8%22%7D%2C%7B%22stateA%22%3A%22s5%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s5%22%7D%2C%7B%22stateA%22%3A%22s5%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s4%22%7D%2C%7B%22stateA%22%3A%22s5%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s8%22%7D%2C%7B%22stateA%22%3A%22s7%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s5%22%7D%2C%7B%22stateA%22%3A%22s7%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s7%22%7D%2C%7B%22stateA%22%3A%22s7%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s8%22%7D%2C%7B%22stateA%22%3A%22s8%22%2C%22label%22%3A%220%22%2C%22stateB%22%3A%22s0%22%7D%2C%7B%22stateA%22%3A%22s8%22%2C%22label%22%3A%221%22%2C%22stateB%22%3A%22s7%22%7D%2C%7B%22stateA%22%3A%22s8%22%2C%22label%22%3A%222%22%2C%22stateB%22%3A%22s8%22%7D%5D%2C%22bulkTests%22%3A%7B%22accept%22%3A%22%22%2C%22reject%22%3A%2200120%5Cn0020%5Cn0%22%7D%7D](http://automatonsimulator.com/#%7B%22type%22%3A%22DFA%22%2C%22dfa%22%3A%7B%22transitions%22%3A%7B%22start%22%3A%7B%220%22%3A%22s0%22%2C%221%22%3A%22s1%22%2C%222%22%3A%22s2%22%7D%2C%22s0%22%3A%7B%220%22%3A%22s5%22%2C%221%22%3A%22s4%22%2C%222%22%3A%22s8%22%7D%2C%22s1%22%3A%7B%220%22%3A%2)

**PLAINTEXT:**

{"type":"DFA","dfa":{"transitions":{"start":{"0":"s0","1":"s1","2":"s2"},"s0":{"0":"s5","1":"s4","2":"s8"},"s1":{"0":"s5","1":"s7","2":"s6"},"s2":{"0":"s0","1":"s6","2":"s6"},"s6":{"0":"s6","1":"s6","2":"s6"},"s4":{"0":"s5","1":"s7","2":"s8"},"s5":{"0":"s5","1":"s4","2":"s8"},"s7":{"0":"s5","1":"s7","2":"s8"},"s8":{"0":"s0","1":"s7","2":"s8"}},"startState":"start","acceptStates":["s5","s4"]},"states":{"start":{},"s0":{"top":68,"left":0,"displayId":"s0"},"s1":{"top":277,"left":325,"displayId":"s1"},"s2":{"top":303,"left":97,"displayId":"s2"},"s5":{"isAccept":true,"top":255,"left":726,"displayId":"s4"},"s4":{"isAccept":true,"top":142,"left":141,"displayId":"s3"},"s8":{"top":35,"left":380,"displayId":"s7"},"s7":{"top":73,"left":797,"displayId":"s6"},"s6":{"top":510,"left":113,"displayId":"s5"}},"transitions":[{"stateA":"start","label":"0","stateB":"s0"},{"stateA":"start","label":"1","stateB":"s1"},{"stateA":"start","label":"2","stateB":"s2"},{"stateA":"s0","label":"0","stateB":"s5"},{"stateA":"s0","label":"1","stateB":"s4"},{"stateA":"s0","label":"2","stateB":"s8"},{"stateA":"s1","label":"0","stateB":"s5"},{"stateA":"s1","label":"1","stateB":"s7"},{"stateA":"s1","label":"2","stateB":"s6"},{"stateA":"s2","label":"0","stateB":"s0"},{"stateA":"s2","label":"1","stateB":"s6"},{"stateA":"s2","label":"2","stateB":"s6"},{"stateA":"s6","label":"0","stateB":"s6"},{"stateA":"s6","label":"1","stateB":"s6"},{"stateA":"s6","label":"2","stateB":"s6"},{"stateA":"s4","label":"0","stateB":"s5"},{"stateA":"s4","label":"1","stateB":"s7"},{"stateA":"s4","label":"2","stateB":"s8"},{"stateA":"s5","label":"0","stateB":"s5"},{"stateA":"s5","label":"1","stateB":"s4"},{"stateA":"s5","label":"2","stateB":"s8"},{"stateA":"s7","label":"0","stateB":"s5"},{"stateA":"s7","label":"1","stateB":"s7"},{"stateA":"s7","label":"2","stateB":"s8"},{"stateA":"s8","label":"0","stateB":"s0"},{"stateA":"s8","label":"1","stateB":"s7"},{"stateA":"s8","label":"2","stateB":"s8"}],"bulkTests":{"accept":"","reject":"00120\n0020\n0"}}

**Ejercicio 3**

Use el AFD del ejercicio anterior para calcular la función de transición extendida para la cadena:

1120201

FUNCIÓN DE TRANSICIÓN

|  |  |  |  |
| --- | --- | --- | --- |
|  | **0** | **1** | **2** |
| **START** | S0 | S1 | S2 |
| **S0** | S4 | S3 | S7 |
| **S1** | S4 | S6 | S5 |
| **S2** | S0 | S5 | S5 |
| **\*S3** | S4 | S6 | S7 |
| **\*S4** | S4 | S3 | S7 |
| **S5** | S5 | S5 | S5 |
| **S6** | S4 | S6 | S7 |
| **S7** | S0 | S6 | S7 |

**FUNCIÓN DE TRANSICIÓN EXTENDIDA**

**w=**1120201

La cadena 1120201 es aceptada, porque de acuerdo a la función de transición extendida, termina en el estado S3, que es un estado de aceptación.