**מערכות זמן אמת -- פתרון תרגיל 6**

**100//**

**מגישים:**

**עאסי חמזה -- 203740782**

**בביצקי ולאד -- 304678642**

**1.**

**א.**

המכפלה המשותפת של ה-**Periods** של המשימות הינה **20, לכן H=20**.

**ב.**

1. f ≥ 3

2.

H = 20 , , => f = 4,5,10,20

3.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **f** | **2f** | **p1=5, d1=7** | **p2=d2=4** | **p3=10, d3=12** | **p4=20, d4=20** | **תקין ?** |
| **gcd(p1, f)** | **gcd(p2, f)** | **gcd(p3, f)** | **gcd(p4, f)** |
| **4** | **8** | **1** | **4** | **2** | **4** | **V** |
| **5** | **10** | **5** | **1** | **-** | **-** | **X** |
| **10** | **20** | **5** | **-** | **-** | **-** | **X** |
| **20** | **40** | **5** | **-** | **-** | **-** | **X** |

מתוך הטבלה מצאנו ש- f=4 הוא הפריים התקיןהיחיד**.**

**ג.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| T1 | T2 | Idle | T3 | T3 | T2 | Idle | T1 | Idle | Idle |

0 1 1.5 2 3 4 4.5 5 6 7 8

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| T2 | Idle | T4 | T4 | T4 | T1 | T2 | Idle | T3 | T3 |

8 8.5 9 10 11 12 13 13.5 14 15 16

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| T1 | T2 | Idle | Idle | Idle |

16 17 17.5 18 19 20

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Task** | **Period** | **Ex. Time** | **Deadline** | **Ui** | **Ni (H/Pi)** |
| **T1** | 5 | 1 | 7 | 1 / 5 = **0.2** | 20 / 5 = **4** |
| **T2** | 4 | 0.5 | 4 | 0.5 / 4 = **0.125** | 20 / 4 = **5** |
| **T3** | 10 | 2 | 12 | 2 / 10 = **0.2** | 20 / 10 = **2** |
| **T4** | 20 | 3 | 20 | 3 / 20 = **0.15** | 20 / 20 = **1** |
|  |  |  |  | **Ut = 0.675 < 1** |  |

**ד.**

**#I** = H \* (1 – UT) = 20 \* (1 – 0.675) = 20 \* 0.325 = **6.5**

נשווה עם התזמון בסעיף הקודם, אכן מתקיים**.**

**3.**

**א.**

המכפלה המשותפת של ה-**Periods** של המשימות הינה **30, לכן H=30**.

**ב.** תזמון בשיטת **LST**:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **T1** | **T1** | **T2** | **T2** | **T2** | **T3** | **T1** | **T1** | **T3** | **T3** |

**0 1 2 3 4 5 6 7 8 9 10**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **T2** | **T2** | **T1** | **T1** | **T2** | **T3** | **T3** | **T3** | **T1** | **T1** |

**10 11 12 13 14 15 16 17 18 19 20**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **T3** | **T3** | **T3** | **T3** | **T2** | **T2** | **T2** | **T1** | **T1** | **Idle** |

**20 21 22 23 24 25 26 27 28 29 30**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **t = 0** | | | **t = 2** | | | **t = 5** | | | **t = 6** | | | **t = 8** | | |
|  | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** |
| **T1** | 2 | 4 | 2 | - | - | - | - | - | - | 2 | 4 | 2 | - | - | - |
| **T2** | 3 | 8 | 5 | 3 | 6 | 3 | - | - | - | - | - | - | - | - | - |
| **T3** | 10 | 25 | 15 | 10 | 23 | 13 | 10 | 20 | 10 | 9 | 19 | 10 | 9 | 17 | 8 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **t = 10** | | | **t = 12** | | | **t = 14** | | | **t = 15** | | | **t = 18** | | |
|  | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** |
| **T1** | - | - | - | 2 | 4 | 2 | - | - | - | - | - | - | 2 | 4 | 2 |
| **T2** | 3 | 8 | 5 | 1 | 6 | 5 | 1 | 4 | 3 | - | - | - | - | - | - |
| **T3** | 7 | 15 | 8 | 7 | 13 | 6 | 7 | 11 | 4 | 7 | 10 | 3 | 4 | 7 | 3 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **t = 20** | | | **t = 24** | | | **t = 27** | | | **t = 29** | | |
|  | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** | **x** | **d** | **s** |
| **T1** | - | - | - | 2 | 4 | 2 | 2 | 1 | -1 | - | - | - |
| **T2** | 3 | 8 | 5 | 3 | 4 | 1 | - | - | - | - | - | - |
| **T3** | 4 | 5 | 1 | - | - | - | - | - | - | - | - | - |

**ג.** תזמון בשיטת **EDF**:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **T1** | **T1** | **T2** | **T2** | **T2** | **T3** | **T1** | **T1** | **T3** | **T3** |

**0 1 2 3 4 5 6 7 8 9 10**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **T2** | **T2** | **T1** | **T1** | **T2** | **T3** | **T3** | **T3** | **T1** | **T1** |

**10 11 12 13 14 15 16 17 18 19 20**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **T3** | **T3** | **T3** | **T3** | **T1** | **T1** | **T2** | **T2** | **T2** | **Idle** |

**20 21 22 23 24 25 26 27 28 29 30**

**ד.**

המערכת אינה ברת-תזמון.

בתזמון המערכת באלגוריתם **LST**, משימה **T1** חורגת מה-Deadline שלה בזמן **28**.   
בתזמון המערכת באלגוריתם **EDF**, משימה **T2** חורגת מה-Deadline שלה בזמן **28**.

המערכת תהיה תקינה אם נגדיל את D1 ל 5 ב, LST- או את D2 ל 9 ב-EDF.

**ה.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Task** | **Period** | **Ex. Time** | **Deadline** | **Ui** | **Ni (H/Pi)** |
| **T1** | 6 | 2 | 4 | 2/6 = 0.333 | 30/6 = 5 |
| **T2** | 10 | 3 | 8 | 3/10 = 0.3 | 30/10 = 3 |
| **T3** | 30 | 10 | 25 | 10/30 = 0.333 | 30/30 = 1 |
|  |  |  |  | **Ut = 0.9666 < 1** |  |

#I = H(1-UT) = 0.0334 \* 30 = 1

**2.**

**א.**

1

0

2

1,2

1,2

0

0,1,2

0

ב.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **0** | **1** | **2** |
| **q0** | q1 | q0 | q0 |
| **q1** | q1 | q2 | q3 |
| **q2** | q1 | q3 | q3 |
| **q3** | q3 | q3 | q3 |