**CS2100 Assignment #2**

AY2024/25 Semester 1

**Deadline: Monday, 14 October 2024, 1:00pm**

TEMPLATE FOR SUBMISSION

36

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Full name: Tutorial grp: **T**

**Q1.** (Total: 15 marks)

13

Cycle time: ps [4 marks]

Clock frequency: GHz [3 marks]

Time taken for beq instruction: ps [3 marks]

Optimization: new [5 marks]

Explain your answers below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Instruction | Register File (ps) | ALU  (ps) | Mem Read (ps) | Mem Write (ps) | Total (ps) |
| addi | 2 | 4 | - | - | 6 |
| lw | 2 | 4 | 5 | - | 11 |
| sw | 2 | 4 | - | 7 | 13 |
| beq | 2 | 4 | - | - | 6 |

Since sw is the slowest instruction (with it having the longest execution time of 13 ps), and the datapath is single-cycle, Cycle Time = 13 ps.

Freq = 1 / Period. Therefore,

Clock Frequency

= 1 / (13 \* 10-12 \* 109)

=   
Note: 10-12 to convert ps to s, 109 to convert Hz to GHz

**Q2.** (Total: 5 marks)

**Q3.** (Total: 3 marks)

(a) [1 mark]

(b) [2 marks]

**Q4.** (Total: 4 marks)

(a) [2 marks]

(b) ( ) [2 marks]

**Q5.** (Total: 3 marks)

Draw your circuit below.

**Q6.** (Total: 7 marks)

(a) Number of PIs in the K-map of : [1 mark]

(b) Number of EPIs in the K-map of : [1 mark]

(c) Number of distinct simplified SOP expressions for : [1 mark]

(d) One simplified SOP expression for : [2 marks]

(e) One simplified POS expression for : [2 marks]

**Q7.** (Total:3 marks)

(a) [1 mark]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| 0 | 0 | 0 | 0 |  |
| 0 | 0 | 0 | 1 |  |
| 0 | 0 | 1 | 0 |  |
| 0 | 0 | 1 | 1 |  |
| 0 | 1 | 0 | 0 |  |
| 0 | 1 | 0 | 1 |  |
| 0 | 1 | 1 | 0 |  |
| 0 | 1 | 1 | 1 |  |
| 1 | 0 | 0 | 0 |  |
| 1 | 0 | 0 | 1 |  |
| 1 | 0 | 1 | 0 |  |
| 1 | 0 | 1 | 1 |  |
| 1 | 1 | 0 | 0 |  |
| 1 | 1 | 0 | 1 |  |
| 1 | 1 | 1 | 0 |  |
| 1 | 1 | 1 | 1 |  |

(b) Simplified SOP expression [2 marks]

**Workings**

Write your workings here. They will not be graded, but the grader might look at it to figure out where you went wrong.

**Workings for Q3**

**K-map for Q6**