

This print-out should have 15 questions. Multiple-choice questions may continue on the next column or page – find all choices before making your selection. The due time is Central time.

EE345L Valvano Homework 5.

001 (part 1 of 1) 10 points

A four-step output sequence repeated over and over will cause a stepper motor to spin.

Which output sequence will rotate a **stepper motor**?

1. None of these choices is correct.
2. 1,2,4,8,1,2,4,8,...
3. 0,1,2,3,0,1,2,3,...
4. 1,2,3,4,1,2,3,4,...
5. 9,10,6,5,9,10,6,5,...

002 (part 1 of 1) 10 points

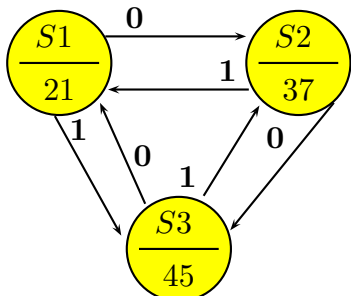
Assume a stepper motor has 200 steps/rot, and the software outputs a new command every 21 ms/step.

Assuming the motor has not stalled, what is the rotational speed of this stepper? Give your answer in rpm.

Answer in units of rpm.

003 (part 1 of 3) 10 points

The following figure shows **Moore** finite state machine. There are three states named **S1 S2 S3**. There is one input signal, connected to PH0, which can be high or low. There is an 8-bit output, connected to PORTJ.



The following program is supposed to im-

plement this **Moore** finite state machine.

```

const struct State{
    xxx Out;
    const struct State *Next [2];
};
typedef const struct State StateType;
#define S1 &FSM[0]
#define S2 &FSM[1]
#define S3 &FSM[2]
StateType FSM[3]={
    {21, {S2,S3}},
    {37, {yyy}},
    {45, {S1,S2}}
};
void main(void){
    char Input;
    StatePtr Pt;
    DDRH = 0;
    DDRJ = 0xFF;
    Pt = S1;
    for(;;){
        PORTJ = Pt->Out;
        Input = PORTH&0x01;
        Pt = Pt->Next [Input];
    }
}
  
```

What C code should be placed in the **xxx** position?

1. None of these choices is correct.
2. **volatile**.
3. **short**.
4. **static**.
5. **char**.
6. **const**.

004 (part 2 of 3) 10 points

What value should be placed in the **yyy** position?

1. **S1,S2**.
2. **S1,S3**.

3. None of these choices is correct.
4. S3,S1.
5. S2,S3.
6. 37.

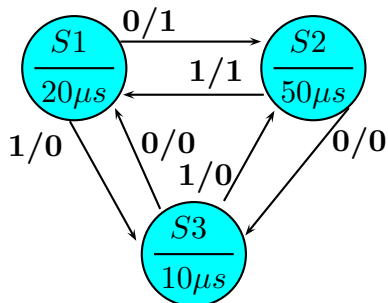
005 (part 3 of 3) 10 points

After running for a while with a constant input value of 1, what pattern of outputs will occur?

1. 21.
2. 45.
3. 45,37,21,45,37,21,....
4. None of these choices is correct.
5. 21,37,45,21,37,45,....
6. 37.

006 (part 1 of 4) 10 points

The following figure shows **Mealy** finite state machine. There are three states named S1 S2 S3. There is one input signal, connected to PJ0, which can be high or low. There is a 16-bit time for each state, which contains the time to wait in microseconds. There is a 1-bit output, connected to PH0.



The following program is supposed to implement this **Mealy** finite state machine. Notice the sequence of actions performed by this controller is 1)wait, 2) read input, 3) perform output, and 4) go to next state. You may assume the **Wait** function delays for the num-

ber of 125ns cycles as specified in the input parameter.

```

const struct State{
    xxx Time;
    char Out [2] ;
    const struct State *Next [2] ;
};
typedef const struct State StateType;
#define S1 &FSM[0]
#define S2 &FSM[1]
#define S3 &FSM[2]
StateType FSM[3]={
    {160, {1,0}, {S2,S3}},
    {400, {yyy}, {S3,S1}},
    {80, {0,0}, {S1,S2}}
};
void main(void){
    char Input;
    StatePtr Pt;
    DDRH = DDRH|0x01;
    DDRJ = DDRJ&0xFE;
    Pt = S1;
    for(;;){
        Wait(Pt->Time);
        Input = PORTJ&0x01;
        zzz
        Pt = Pt->Next [Input] ;
    }
}
  
```

What code should be placed in the **xxx** position?

1. static.
2. char.
3. long.
4. short.
5. volatile.

007 (part 2 of 4) 10 points

What value should be placed in the **yyy** position?

1. S2,S3.
2. S1,S2.

3. 0,1.

4. 0,0.

5. 1,0.

008 (part 3 of 4) 10 points

What code should be placed in the **zzz** position?

1.

```
PORTJ = Pt->Out;
```

2.

```
PORTH = Pt->Out [Input];
```

3.

```
PORTH = Input;
```

4.

```
PORTH = Out [Input];
```

5.

```
PORTH = Pt->Out;
```

6.

```
PORTH = PORTJ;
```

009 (part 4 of 4) 10 points

After running for a while with a constant input value of 0, what pattern of outputs will occur?

1. A constant low.

2. Can not be determined from this information.

3. A constant high.

4. A repeating pattern of an output high for 50 us, followed by an output low for 30 us.

5. A repeating pattern of an output high for 20 us, followed by an output low for 60 us.

010 (part 1 of 1) 10 points

What is the difference between a **Mealy** finite state machine and a **Moore** finite state machine?

1. The outputs of a **Mealy** finite state machine depend just on the state, while the outputs of a **Moore** finite state machine depend on both the state and the input.

2. The outputs of a **Moore** finite state machine depend just on the state, while the outputs of a **Mealy** finite state machine depend on both the state and the input.

3. The outputs of a **Moore** finite state machine depend just on the state, while the outputs of a **Mealy** finite state machine depend on just the the input.

4. None of these choices is correct.

5. A **Moore** finite state machine is more efficient than a **Mealy** finite state machine.

6. A **Mealy** finite state machine allows for a time delay in each state, while a **Moore** finite state machine does not.

011 (part 1 of 1) 10 points

Which address is the output compare 0 vector?

1. 0xFFFF0

2. 0xFFEE

3. 0xFFFFE

4. 0xFFE0

5. 0xFFFFA

6. none of the other answers is correct.

012 (part 1 of 1) 10 points

Which interrupt number do you use when compiling an output compare 7 ISR using

Metrowerks? For example, what number goes into the **xx** spot in the following C code?

```
interrupt xx void handler(void){
    TC7 = TC7+20000;
    TFLG1 = 128;
}
```

013 (part 1 of 1) 10 points

Which software arms the output compare channel 4 on the 812A4? For the 9S12C32, substitute **TIE** for **TMSK1** and substitute **TSCR1** for **TSCR**. If more than one software is possible, choose the friendly version.

1.

```
TSCR = 0x80;
TIOS |= 0x10;
TMSK1 &= 0xEF;
```

2.

```
TSCR = 0x80;
TIOS = 0xFF;
TMSK1 = 0xFF;
```

3.

```
TSCR = 0x80;
TIOS |= 0x10;
TMSK1 = 0x10;
```

4.

```
TSCR = 0x80;
TIOS |= 0x10;
TMSK1 |= 0x10;
```

5.

```
TSCR = 0x80;
TIOS |= 0x10;
TFLG1 |= 0x10;
```

6.

```
TSCR = 0x80;
TIOS |= 0x10;
TMSK1 = 0x00;
```

014 (part 1 of 1) 10 points

On both the 812A4 and the 9S12C32, the timer channel 7 flag, **C7F**, is bit 7 of the

TFLG1 register. Assume the channel is configured as output compare. Which of the following statements best describes the software action that will set the timer channel 7 flag?

1. The software reads the **TCNT** register.

2. The software writes a 1 to the **C7F** bit.

```
TFLG1 = 0x80;
```

3. The software can not set **C7F**, but this bit is set by the timer hardware when **TC7** matches **TCNT**.

4. The software executes the **swi** instruction.

5. The software executes the **rti** instruction.

6. The software writes a 0 to the **C7F** bit.

```
TFLG1 = 0x00;
```

015 (part 1 of 1) 10 points

On both the 812A4 and the 9S12C32, the timer channel 0 flag, **C0F**, is bit 0 of the **TFLG1** register. Which of the following statements best describes the action that will clear this timer channel 0 flag?

1. The software writes a 1 to the **C0F** bit.

```
TFLG1 = 0x01;
```

2. The software can not clear **C0F**, but this bit is periodically cleared by the timer hardware.

3. The software executes the **sei** instruction.

4. The software reads the **TCNT** register.

5. The software executes the **cli** instruction.

6. The software writes a 0 to the **C0F** bit.

```
TFLG1 = 0x00;
```