Supplementary tutorial question

Q1. Figure Q1a shows an 82C55 PIA which serves as a parallel interface to two output devices with its two parallel ports. The system is designed in a way that the two devices share one INTR pin to interrupt the 80286 if necessary. The two output devices are connected to the ports of the PIA as specified in Table Q1. Figure Q1b shows the assembly program code of the interrupt service routine executed when 80286 recognizes a request at its INTR pin.

![Figure Q1a](image1.png)

<table>
<thead>
<tr>
<th>Device</th>
<th>Connected to</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>port A</td>
</tr>
<tr>
<td>D2</td>
<td>port B</td>
</tr>
</tbody>
</table>

Table Q1

INT service routine

ISR: 
- MOV DX, Addr_StatusWord ; Read status word of 82C55
- IN AL, DX
- AND AL, 08H ; check if device D1 generates the interrupt
- JNE Serve_D1 ; JMP Serve_D1 if Yes
- Serve_D2: CALL SERVE_D2 ; serve device D2
- IRET
- Serve_D1: CALL SERVE_D1 ; serve device D1
- IRET

![Figure Q1b](image2.png)
(a) Determine the addresses of port A, port B, port C and the command register of the 82C55.  

(4 marks)

(b) Write a command to the 82C55 to configure its Port A and Port B to operate as mode 1 output ports such that the system functions properly.  

(2 marks)

(c) Determine the interrupt vector number of the interrupt service routine.  

(2 marks)

(d) The system is now operating in protected mode. Figure Q1c shows parts of the current interrupt descriptor table (IDT) and the current local descriptor table (LDT). Determine the starting address of the interrupt service routine.

![Figure Q1c](image)

(6 marks)

(e) It is desirable that device D1 is of a higher priority than device D2 to be served. Determine if the interrupt service routine shown in Figure Q1b is appropriate. Modify it if it does not.  

(2 marks)

(f) Explain why there is a potential problem in the interrupt service routine provided in Figure Q1b.  

(3 marks)

(g) Modify the interrupt service routine given in Figure Q1b so as to eliminate its potential problem.  

(6 marks)