1. Data Monitoring
Write a C subroutine "checkspeed" for the Nano controller to perform the following function:

Speed is read as an 8-bit unsigned integer that needs to be read from port B. If speed is greater or equal to 100 (decimal) it switches on a warning light; otherwise, the light is turned off. The warning light is controlled by bit 4 on port D. A "1" on bit 4 turns on the light and a 0 turns it off. The other bits of port D are used for other functions.

This program should loop forever.

Write a C program to solve this task.
2. Temperature Control

A Nano microcontroller is used to control the temperature in this room. The microcontroller has been hooked up such that the 8-bit signed number stored at address $0400$ represents the temperature in this room in degrees Celsius. Also, a switch that controls the heater for this room is connected to Bit 0 of PORT D, and a switch that controls the air conditioner for this room is connected to Bit 4 of PORTD.

Writing a 0 to Bit 0 turns the heater off; writing a 1 to Bit 0 turns the heater on. Writing a 0 to Bit 4 turns the air conditioner off; writing a 1 to Bit 4 turns the air conditioner on.

Write a **C program** (with assembly sub-programs, if required) microcontroller, which will do the following:

- Set up Bits 0 and 4 of PORTD as output bits. The other bits of PORTD should be set up as inputs.
- If the temperature in the room is below 20 degrees, make sure the air conditioner is off and the heater is on.
- If the temperature in the room is between 20 and 24 degrees, make sure both the heater and air conditioner are off.
- If the temperature in the room is above 24 degrees make sure the air conditioner is on and the heater is off.
- Repeat this set of instructions forever.
3. **Sensor Connection**
An external digital compass has been connected to the Nano controller in the following way:

- Port B, bit 7 (output) is connected to the compass Start line
- Port B, bit 6 (input) is connected to the compass Ready line
- The compass’ 8-bit data output has been connected to port D

![TIMING DIAGRAM](image)
The CPU can request a data value from the compass sensor by raising and subsequently lowering the Start signal. The compass will indicate that a valid sensor value is available at its output by raising the Ready signal.

Write a **C subroutine** to do a single data request/ wait / read cycle. Assume that "start" and "ready" are active high.