# Take Home Test

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# 1 Question

1. Assess yourself, from 1 to 4, in the following areas or skills. We are not looking for a candidate to have experience with all, or even a majority, of these areas. This question is much less about the magnitude of the numbers and more about their relation – where do you think your strengths are?

1 = Very little or no experience
2 = Some experience, but not yet at a level of full competence and confidence
3 = A lot of experience, generally able to do this work at a professional level
4 = Very experienced, typically the expert on my team or among peers

- PID control
- Model predictive control
- Optimal control methodologies
- Dynamic systems modeling
- Microcontrolers
- Scripting languages
- C/C++
- Software version control
- Experimental design
- Instrumentation
- Data acquisition (NI or other DAQ)
- Project management
- Written communication
- Presentation
- Heat transfer
- Thermodynamics
- Fluid mechanics

**Answer**

| Skill | Level | Description | Support |
|---|---|---|---|
| PID Control | 4 | — | — |
| Model Predictive Control | 2 | — | I need to put in the time on this one, external support not required. |
| Optimal Control | 2 | I need to learn more about dynamic programming for dynamic optimization. But I do kalman filters and LQR | — |
| Dynamic systems modeling | 4 | ODEs are friendly, PDEs are within reach | A thermal science expert, to bake what they know into the dynamics |
| Microcontrollers | 3 | — | Firmware engineer to own OS/drivers |
| Scripting languages | 4 | Matlab | — |
| C/C++ | 2 | — | Firmware engineer to fill the gap, though I can (and desperately want to) come up to speed with this. Expect me to become useful on this within a quarter or two or joining. I have in the past done all my work including real-time code in Simulink |
| Software version control | 2 | I use it regularly | Git Wrangler |
| Experimental Design | 1 | I just googled this | — |
| Instrumentation | 2 | It's the systems/test engineer that has handled this in my experience, but I can do this. Related skill - I generally pick sensors and decide (with electrical engineer) interfacing with the micro. | I will need to read the manual on thermocouples, anemometers, etc |
| Data acquisition (NI or other DAQ) | 2 | Same answer as 'Instrumentation' | — |

| | | | |
|---|---|---|---|
| Project management | 3 | Part of my responsibility is to scope out my work. As I have spent time in thermal teams, there's no one to guide me on this. | — |
| Written communication | 3 | I hope you like this document. | — |
| Presentation | 3 | — | — |
| Heat transfer | 3 | I have a working knowledge of heat transfer. I don't calculate convective heat transfer coefficients or design HXs. But if I know the U value as a function of inner/outer mdots, I can create a simulation no problem. | Thermal Engineer |
| Thermodynamics | 3 | By example - I am very comfortable with P-h diagrams, and we should add mdot as a 3rd dimension to contemplate operating points for a constant evaporator power flux to make it complete. I cannot derive the equation of work done for polytropic compression, though I find that equation quite useful for the compressor | Thermal Engineer |
| Fluid mechanics | 2 | — | Thermal Engineer |