

# VMW Python Minecraft Course Outline

The purpose of this course is to give students a foundation in computer science and a computational way of thinking, while remaining appealing and engaging to the young target audience. Enable scripting with makecode provides an amazing platform to teach the foundations of coding, as it lets the students see what their code is doing quickly and in a game they definitely love. Minecraft is the most popular game in the world, and having the ability to teach a student while effectively letting them “play” it makes for a class that they will be excited for and pay attention in.

Every student learns at a different pace and has different strengths. I designed this course with that in mind, and left a lot of room for instructor improvisation to make sure all of the students spend their time in class learning. I also tried to give the students as many creative projects as I realistically could, such as choosing their own superpower to make in Minecraft, or the final assignment of using code to make a complex functional minigame that is playable. Giving the students this creative freedom allows for the students to challenge themselves to whatever level they are at. If a student is rather skilled and picking up on the topics quickly, they can be more ambitious with a project like this so that every one is learning to their fullest potential. Having the students choose their projects and designs also makes them more invested in the work they are doing, and it undoubtedly helps get them excited about all the new concepts they will learn later on - notably once they are no longer working with Minecraft. It is crucial that no student feels that coding “isn’t meant for them” or “it’s too hard”. I am a strong believer that everyone should learn at least a basic competency of computer science and coding in a rapidly automating world, and having a course that hides behind the facade of a student’s favourite video game ensures that they are getting the best introduction to computer science possible. This course maximizes the chance that a young mind will take to coding and continue to learn on their own merit.

This course covers a beginner to intermediate competency of Python through lessons taught in Minecraft. It also provides the students with a basic computer science knowledge, far ahead of what the adult knows. The course also uses Minecraft building assignments to teach the students about historical architecture, and how the laws of physics affect creating a structure.

Below is a formal lesson plan of what subjects are covered in each of the 10 lessons, and the homework that is assigned after each.

NOTE: This course plan is a basic workflow, and all subjects listed will be covered. The course may end up being more accelerated and having extra content taught - depending on the competency level and speed of the given class. The learning goals will remain the same, but the course structure is subject to change.

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Lesson #	Class itinerary	Computer Science learning goals covered	Homework assigned
1	<ul style="list-style-type: none"> <li>• Course introduction</li> <li>• What to expect from this course, and what will be covered</li> <li>• 2D Positive coordinate tutorial</li> <li>• 2D Integer coordinate tutorial</li> <li>• 3D Integer Coordinate tutorial</li> <li>• “Chicken Rain” block code tutorial</li> <li>• Intro to how computers work (video)</li> <li>• “Animal Rain” project assignment               <ul style="list-style-type: none"> <li>○ Challenge assignment - “Prison Maker”</li> <li>○ Challenge assignment - “Diamond Ceiling”</li> </ul> </li> <li>• Getting set up on the VMW Minecraft homework server (hosted by instructor)</li> <li>• Bridge examples for homework inspiration</li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• What is a computer?</li> <li>• What is a computer’s job?</li> <li>• What are the similarities between all computers?</li> <li>• What are computers used for?</li> <li>• What are the <u>4 main jobs</u> that every computer has to do?</li> </ul>	<p>-Complete any 2 of 4 listed homework coding problems</p> <p>-Watch 5 minute video on introduction to computer networks and the internet</p> <p>-Build a bridge on the server that is physically realistic, using the design concepts shown in class</p>
2	<ul style="list-style-type: none"> <li>• Discussion of last week’s homework</li> <li>• Extensive review of solutions to last week’s homework</li> <li>• Introduction to binary numbers</li> <li>• Walkthrough of how to convert a binary to decimal number</li> <li>• Practice problems for how to convert a binary to a decimal number</li> <li>• Walkthrough of how to convert a decimal to a binary number</li> <li>• Practice problems for how to convert a decimal to a binary number</li> <li>• Spleef practice game on server and arena setup explanation</li> <li>• “Spleef Arena” block code assignment</li> <li>• Introduction to variables</li> <li>• Types of variables and what they represent</li> <li>• “Mega jump” block code tutorial</li> <li>• “Platform x” block code assignment</li> </ul>	<ul style="list-style-type: none"> <li>• What is a binary number?</li> <li>• Why do computers use binary?</li> <li>• How do you convert from decimal to binary?</li> <li>• How do you convert from binary to decimal?</li> <li>• What are variables?</li> <li>• What does each variable type represent?</li> </ul>	<p>-Complete the assigned worksheet on binary numbers and variables</p> <p>-Come up with minimum 2 superpowers that you want to make in minecraft next class</p>

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	<ul style="list-style-type: none"> <li>• “Spleef” block code tutorial</li> <li>• Looking at other students' bridges from the previous week's homework. <i>This will only be done for students that volunteer to show their work. No student is forced to show what they built ever in this course.</i></li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• When do you need to use variables?</li> </ul>	
3	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> <li>• “Spleef Arena” pt. 2, <i>a more difficult but similar problem to ensure the material was understood</i></li> <li>• Practice problems for how to convert a <u>large</u> binary to a decimal number</li> <li>• Practice problems for how to convert a <u>large</u> decimal to a binary number</li> <li>• Review of variable types</li> <li>• Practice attributing data to variable types</li> <li>• “Super Powers” block code tutorial</li> <li>• Passion project assignment - Making your superpowers come to life <ul style="list-style-type: none"> <li>○ If a student does not have an instructor approved super power that they are passionate about to work on, they will be given a choice of 4 different super power ideas to make before the end of the class ideally.</li> <li>○ The instructor will code a solution for any student that was unable to get their idea working so they can see how it should have been done</li> </ul> </li> <li>• Introduction to beginner Minecraft redstone</li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• What is a binary number?</li> <li>• Why do computers use binary?</li> <li>• How do you convert from decimal to binary?</li> <li>• How do you convert from binary to decimal?</li> <li>• What are variables?</li> <li>• What does each variable type represent?</li> <li>• When do you need to use variables?</li> </ul>	<p>-Complete any 2 of 4 listed homework coding problems</p> <p>-Watch 7 minute video on introduction to Minecraft redstone circuits</p> <p>-Build an advanced redstone project on the Minecraft server. <i>We begin computer logic and circuits next class, so learning redstone is a great introduction to how actual electrical circuits work. Some example redstone projects will be given, and the students will be encouraged to be creative and ambitious with their ideas.</i></p>

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4	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> <li>• Python introduction</li> <li>• Explanation of why we are going to switch to using python instead of block code</li> <li>• "Chicken rain" python tutorial</li> <li>• Converting "Animal rain" to python code (tutorial)</li> <li>• Converting "Spleef Arena" to python code</li> <li>• "Walk on water" python code assignment</li> <li>• Introduction to the internet and networks</li> <li>• What is an ip (video)</li> <li>• Lesson and practice questions on how a network is set up</li> <li>• "Wipeout" python code problem</li> <li>• Introduction to formal Minecraft redstone</li> <li>• Looking at students redstone homework from the previous week</li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• What is an ip?</li> <li>• What is a router?</li> <li>• What is a network?</li> <li>• What are some examples of networks?</li> <li>• How is the internet structured?</li> <li>• What is a circuit?</li> <li>• How is a computer made of circuits?</li> </ul>	<p>-Complete any 2 of 4 listed homework coding problems. <i>These problems must be done in python now instead of block code</i></p> <p>-Watch a 6 minute video on how the internet works. <i>This video is an extension of the video watched for homework in week 1. It builds on the concepts that are taught in the week 4 class.</i></p> <p>-Build an advanced redstone project on the Minecraft server. <i>The subject of this project will be personalized to the student based on what they chose to make in the previous week, but it must make use of the "repeater" block, which functions like a real life resistor.</i></p>
5	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> <li>• Converting "Super Powers" assignment to python code, and adding something to it with the &lt;on_movement&gt; command</li> <li>• Introduction to circuits and logical operators</li> <li>• Practice problems on each of the 3 primary logic gates</li> </ul>	<ul style="list-style-type: none"> <li>• What is a circuit?</li> <li>• How is the internet related to circuits?</li> <li>• How does Minecraft redstone relate to the circuits in computers?</li> </ul>	<p>-Complete any 2 of 4 listed homework coding problems.</p> <p>-Complete the assigned worksheet on logical operators and truth tables</p>

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	<ul style="list-style-type: none"> <li>• Introduction to truth tables and what they mean</li> <li>• Truth table construction practice problems</li> <li>• “Zombie Pig” python assignment</li> <li>• “Build a House” python assignment</li> <li>• Looking at students redstone homework from the previous week</li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• What is an AND gate?</li> <li>• What is an OR gate?</li> <li>• What is an XOR gate?</li> <li>• How do we write all of the logical gates, as both a logical expression and as a circuit diagram?</li> <li>• How do you construct a truth table?</li> </ul>	
6	<ul style="list-style-type: none"> <li>• Discussion of last week’s homework</li> <li>• Extensive review of solutions to last week’s homework</li> <li>• Introduction to TNT cannons</li> <li>• “TNT Cannon” code assignment</li> <li>• Review of “TNT Cannon” code solution</li> <li>• “Marco Polo” code assignment</li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• How does Minecraft redstone relate to the circuits in computers?</li> <li>• What is an AND gate?</li> <li>• What is an OR gate?</li> <li>• What is an XOR gate?</li> <li>• How do we write all of the logical gates, as both a logical expression and as a circuit diagram?</li> <li>• How do you construct a truth table?</li> <li>• How do you construct a logic circuit?</li> <li>• What are the components of an electrical</li> </ul>	<p>-Complete the assigned worksheet on logical operators and truth tables. This involves creating a circuit to satisfy a given truth table.</p> <p>-Build a Minecraft TNT cannon with redstone on the minecraft server</p>

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		<ul style="list-style-type: none"> <li>circuit?</li> <li>• What symbols represent the 3 primary logical operators?</li> </ul>	
7	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> </ul>	<ul style="list-style-type: none"> <li>• What are the components of a computer?</li> <li>• What is RAM?</li> <li>• What is a processor?</li> <li>• What is an operating system?</li> <li>• What does an operating system do?</li> <li>• What is a monitor?</li> <li>• What does a motherboard do?</li> <li>• Why do computers need fans?</li> <li>• How does a computer store data?</li> <li>• What's the difference between HDD and SSD</li> <li>• How does a computer use circuits</li> </ul>	<ul style="list-style-type: none"> <li>-Complete any 2 of 4 listed homework coding problems.</li> <li>-Complete the assigned worksheet on computer parts</li> <li>-Build a house on the server that is physically realistic, using the design concepts shown in class. <u>This can be done in groups of 1 or 2.</u></li> </ul>
8	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> <li>• Introduction to minigame final</li> </ul>	<ul style="list-style-type: none"> <li>• How do you add binary numbers?</li> <li>• How do you</li> </ul>	<ul style="list-style-type: none"> <li>-Work on minigame assignment</li> </ul>

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	assignment	<p>subtract binary numbers?</p> <ul style="list-style-type: none"> <li>• How do you use a logic circuit to add binary numbers?</li> <li>• How do you use a logic circuit to subtract binary numbers?</li> <li>• How do logic circuits work with binary numbers?</li> <li>• Could a logic circuit work with decimal numbers?</li> <li>• What is a bit, byte, and terabyte?</li> <li>• How is data stored in a computer?</li> </ul>	
9	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> <li>• Work on minigame assignment</li> <li>• Tutorial on installing a specified Python IDE (likely IDLE)</li> <li>• Introduction to Python 3</li> <li>• "Hello World" problem</li> <li>• How to define variables and functions in Python</li> <li>• Homework and what to expect next class</li> </ul>	<ul style="list-style-type: none"> <li>• How do you declare a function in Python 3</li> <li>• How do you declare a variable in Python 3?</li> <li>• What are the benefits of Python vs JavaScript</li> <li>• What is an IDE?</li> <li>• How does a</li> </ul>	-Work on minigame assignment

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		<p>Python calculator work?</p> <ul style="list-style-type: none"> <li>• What are some limitations of Python?</li> <li>• When should you use a function?</li> <li>• What does a for statement do?</li> <li>• What does a “pass” statement do?</li> <li>• How do you comment out code in Python?</li> </ul>	
10	<ul style="list-style-type: none"> <li>• Discussion of last week's homework</li> <li>• Extensive review of solutions to last week's homework</li> <li>• Work on minigame assignment</li> <li>• “Calculator” problem on IDLE</li> </ul>	<ul style="list-style-type: none"> <li>• What is an algorithm?</li> <li>• What is a subprogram?</li> <li>• What is sampling?</li> <li>• What is a subsample?</li> <li>• When is sampling necessary?</li> <li>• How do you make your own code projects?</li> <li>• How do you export your makecode files as python files that can be run with Minecraft without a code connector?</li> </ul>	-Last lesson, no homework!



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		<ul style="list-style-type: none"><li>• What will we learn in the next 10 week session if you choose to continue?</li></ul>	
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Please note:

The lesson itinerary for classes 4-10 are not fully fledged and will be significantly added to. This is because this course is in construction and is currently going into lesson 3 next week. Expect the same level of detail every week as is given in the first 3.

I am making extensive powerpoints to use during every class, as well as homeworks designed from scratch relevant to the topics learned each week. I do these one week in advance for the sake of time management. If I committed to a strict schedule in the later lessons now before ever teaching them, this could turn out badly. I may not have gauged the student's speed well enough, or made the problems too hard. Producing the lessons in full week by week allows me to make the course better for the students. I also customize this itinerary to the students based on the first class, and if a class is particularly fast I will modify the homework to make it harder.