AIC2025: Minecraft

1 Lore

The Minecraft gameplay pattern has been stale since 2011. There is no point on trying to get resources if there is no progression in the game. However, the developers have announced that this year, 2012, they have launched another update with several new features!

We are sure you are busy trying all the new stuff, but there is no time to spare. As seen in the recent news articles, China has successfully killed the Wither, and now has the resources necessary to activate a beacon!

The rest of the world can't be standing like this as if nothing is happening, we need to investigate the most efficient ways of producing these structures to enhance productivity around the world, and we need to get results fast!

This is why we are asking your team to explore new land and expand as fast as possible. As 30 crafters, you are unstoppable! That is, unless another team had the same idea as you...

2 The Game

The objective of both teams is to build 5 beacons in 2000 rounds. However, if a team manages to destroy all opponent's beds, they win automatically, regardless of the beacons placed by either team. If both teams survive until the end and no team has managed to build 5 beacons, the winner team is chosen according to the following criteria, in order:

1. The team with more placed Beacons.
2. The team with more total weight (carried by units).
3. Randomly.

3 Map

The map consists of a grid of dimensions between 30×30 and 60×60.

Each tile always contains a material and may contain a unit and/or a structure (it can have both). Units and structures occupy exactly one tile and there can't be two units or two structures on the same tile (although there can be a structure and a unit).

The map may also contain biomes, which affect the probability of certain materials to appear in nearby tiles.

Units have finite vision range. Moreover, the vision between units is not shared. This means that all objects on the map that are outside of a given unit's vision range cannot be queried during that unit's turn.

Each team starts with thirty units (crafters) outside the map, and between one and three beds. It is guaranteed that all maps are symmetric. This symmetry may be horizontal, vertical or rotational, and it also applies to the random materials that appear.

This year **maps do not have an offset**. That means that a map with dimensions (X, Y) will have as corners locations [0,0], [X-1, 0], [0, Y-1] and [X-1, Y-1]. Units can also query the dimensions of the map at any time.

4 Spawning and Beds

This is a new feature for this year's edition. There are **always 30** crafters on each team at all times, but they start outside of the map. Whenever a crafter is outside the map, it cannot craft or perform any action that incurs in cooldown (e.g., moving, using craftables, etc.).

While outside the map, a crafter can claim a bed (of their own team) of the map to spawn on it. Doing so will occupy the bed until that crafter leaves the map ("dies"), which happens when its health reaches 0. When the crafter dies, no new crafters can claim its bed until a 25 turn cooldown has elapsed. New beds can be crafted and placed to allow more concurrent alive crafters on the map (again, with a maximum of 30). This means that it's possible to have no alive crafters without losing.

5 Materials and Biomes

Land tiles all start as DIRT, but they get transformed after 50 turns into a random resource. The only exception is the very first round of the game, in which they all transform immediately. The probability of transforming into a different resource depend on the biome they are in, and the exact values are shown in the following table.

Material Name	**Base Spawn Rate**	**Forest Spawn Rate**	**Cave Spawn Rate**	**Tool**	**Tool Required**
VOID	0.0	0.0	0.0	-	-
WATER	0.0	0.0	0.0	-	-
DIRT	0.0	0.0	0.0	-	-
GRASS	0.8855	0.795	0.78	SHOVEL	No
POTATO	0.01	0.075	0.0	SHOVEL	No
STRING	0.01	0.03	0.0	AXE	Yes
WOOD	0.03	0.06	0	AXE	No
LEATHER	0.01	0.03	0.0	AXE	Yes
STONE	0.03	0.01	0.06	PICKAXE	No
COPPER	0.01	0	0.06	PICKAXE	Yes
IRON	0.01	0.0	0.05	PICKAXE	Yes
GOLD	0.003	0.0	0.03	PICKAXE	Yes
DIAMOND	0.0015	0.0	0.02	PICKAXE	Yes

Biomes are circles of radius (squared) 25 around a given tile. Which tiles belong to which biomes is hidden from the units: they cannot directly query the biome of the tiles but they can maybe deduce it from the spawn rate of materials.

Materials other than VOID, WATER and DIRT can be picked up by crafters. Some of them can be gathered without tools, but others do require a tool to mine them. Doing so will replace them with DIRT.

After the material has been gathered, the crafter is put on an action cooldown (10 rounds), which can be sped up (to 1 round) if the crafter uses the correct tool to mine the desired material. In the documentation, mining without a tool (10 round action cooldown) is called "gather", and mining with a tool (1 round action cooldown) is indicated by using a tool on the target location.

Each carried material increases crafter weight by 10 (weight increases cooldowns, see more details in section 9).

6 Craftables

Craftables are created using materials. Each craftable has a specific recipe, which indicates the amount of each material necessary to craft it.

There are 4 main types of craftables:

- Blueprints: They are placed in the map
- Tools: Give the unit a special ability permanently
- One-time use: They can be used (and consumed) for a special effect
- Passives: Give the unit a special passive permanently

These are the following blueprints. The effect of each one is explained in section 8.

Blueprint	**Weight**	**Recipe**	**Use Range**
BED BLUEPRINT	50	2 STRING, 2 WOOD	2
CHEST BLUEPRINT	5	2 WOOD	2
ROAD BLUEPRINT	5	1 STONE	2
BRIDGE BLUEPRINT	5	1 WOOD	2
TURRET BLUEPRINT	50	2 WOOD, 2 STONE, 2 COPPER	2
COMPOSTER BLUEPRINT	25	4 POTATO	2
BEACON BLUEPRINT	100	$1^{(*)}$ IRON, $1^{(*)}$ GOLD, $1^{(*)}$ DIAMOND	2

(∗) BEACON BLUEPRINT costs one more unit of IRON, GOLD and DIAMOND for each BEACON BLUEPRINT previously crafted by the same team.

List of all tools:

Tool	**Weight**	**Recipe**	**Range**	**Effect when used**
AXE	100	1 WOOD, 2 STONE	2	Deal 1 damage or chop materials
PICKAXE	100	2 WOOD, 1 STONE	2	Deal 1 damage or mine material
SHOVEL	100	1 WOOD, 1 STONE	2	Deal 1 damage or excavate material
SWORD	100	3 COPPER	2	Deal 3 damage
BOW	120	2 STR, 2 WOOD, 2 COP	10	Deal 2 damage
BOOTS	50	3 LEATHER	2	Move to adjacent location
BUNDLE	20	3 LEATHER	5	Steal 1 random material from target
FISHING ROD	50	2 STRING, 2 WOOD	18	Pull target crafter to your direction

List of one-time use craftables:

Craftable	**Weight**	**Recipe**	**Range**	**Effect when used**
TNT	30	4 COPPER	18	Deal 10 damage to target structure
BAKED POTATO	10	1 POTATO	5	Heal target crafter for 3
GRINDSTONE	20	1 WOOD, 1 STONE	2	Heal target structure for 4
ENDER PEARL	20	1 STRING, 1 LEATHER	18	Teleport to target location
FIREWORK	20	1 STRING, 1 LEATHER	10	Deal 4 damage
SNOWBALL	20	1 STRING, 1 LEATHER	10	Adds 2 action cooldown to target

List of passive craftables:

Craftable	Weight	Recipe	Passive
ARMOR	100	2 LEATHER, 2 COPPER	Reduces all damage received by 1
SHIELD	35	3 COPPER	Ignores fireballs and snowballs
BOAT	100	3 WOOD	Allows to go in the water
RESPAWN ANCHOR	20	2 STRING, 2 GOLD	Keeps all resources on death
SPYGLASS	30	3 COPPER	Increases vision range to 40

Lastly, there are 3 upgrade materials (IRON, GOLD and DIAMOND). Some owned craftables can be upgraded with one item of the desired upgrade to make the craftable have less weight (having more weight increases cooldowns, see section 9 for more details).

Craftable	Base Weight	IRON Weight	GOLD Weight	DIAMOND Weight
BED BLUEPRINT	50	50	50	50
CHEST BLUEPRINT	5	5	5	5
ROAD BLUEPRINT	5	5	5	5
BRIDGE BLUEPRINT	5	5	5	5
TURRET BLUEPRINT	50	50	50	50
COMPOSTER BLUEPRINT	25	25	25	25
BEACON BLUEPRINT	100	100	100	100
AXE	**100**	**70**	**50**	**20**
PICKAXE	**100**	**70**	**50**	**20**
SHOVEL	**100**	**70**	**50**	**20**
BOOTS	**50**	**40**	**25**	**15**
BOW	**120**	**80**	**60**	**30**
BUNDLE	**20**	**15**	**10**	**5**
SWORD	**100**	**70**	**50**	**20**
FISHING ROD	**50**	**40**	**25**	**15**
TNT	30	30	30	30
BAKED POTATO	10	10	10	10
REPAIR KIT	20	20	20	20
ENDER PEARL	20	20	20	20
FIREWORK	20	20	20	20
SNOWBALL	20	20	20	20
ARMOR	**100**	**70**	**50**	**20**
SHIELD	**35**	**25**	**15**	**10**
BOAT	**100**	**70**	**50**	**20**
RESPAWN ANCHOR	20	20	20	20
SPYGLASS	**30**	**25**	**15**	**10**

7 Crafters

Each crafter has a unique identifying number (ID) chosen randomly between 1 and 10.000.

The parameters of crafters are indicated in the following table. All distances are shown in squared units. For instance, a crafter with 12 vision range at $(0, 0)$ can query which object is at $(2, 1)$ since $2^2 + 1^2 \leq 12$, but it cannot query which object is at $(2, 3)$ since $2^2 + 3^2 > 12$.

Movement Range	2
Vision Range	20
Movement Cooldown	1
Maximum Health	7
Base Weight	100

The movement and action cooldowns are affected by weight (see Section 9 for more details), which is the cumulative weight of the unit and all the carried materials and craftables.

8 Structures

There are several structures that can appear on the map. Structures are created by placing blueprint craftables, and they have 5 health with some exceptions. Some structures are owned by a team (Bed, Turret, Beacon) and others are neutral (Chest, Road, Bridge, Composter). If a structure is built in some tile, that tile changes its material to DIRT, and it stays that way until the structure is removed (this also applies to water with bridges). When this happens, DIRT may transform into other materials.

- Bed: Used by a crafter to spawn on the map, and owned by a certain team. The bed remains occupied as long as the crafter that spawned on it is alive. When a bed is not occupied, a dead crafter of the bed's team can claim it to spawn on it.
- Chest: Used to store items and materials. Each chest can hold an infinite amount of each craftable and material. Chests are not owned, meaning any unit from any team can interact with them. This is the only way to allow exchange of items between crafters.
- Road: Can be placed on land, and reduces movement cooldown by half when moving from a road.
- Bridge: Can be placed on water.
- Turret: Attacks all enemy crafter in range after each round. It deals 2 damage and has an attack range of 13 square units. It has 10 health.
- Composter: Reduces time taken from dirt to convert to a material by half for all tiles in a 18 radius around the composter tile.
- Beacon: It does nothing when placed. The first team to have 5 beacons simultaneously placed in the map wins the game. It has 30 health.

9 Cooldowns

Crafters can only move whenever their movement cooldown is strictly less than 1. Every time that the crafter moves, its movement cooldown increases by 1. If the crafter moves in a diagonal direction, the cooldown added is multiplied by 1.4142, which is approximately $\sqrt{2}$.

In a similar way, there is also an action cooldown and crafters can only use craftables or broadcast if the action cooldown is strictly less than 1. This action cooldown increases by 1 every time the crafter uses a craftable, increases by 2 when it gets hit by a snowball, and increases by 10 every time the crafter gathers a material.

All stated action and movement cooldown increases are also multiplied by the crafter weight $\times 0.01$. Crafters start with 100 weight. This means that, if a crafter is carrying 200 weight in materials, all movement and action cooldowns will be tripled (weight multiplier $= (100 + 200) \times 0.01 = 3$).

At the beginning of every turn, the movement cooldown and action cooldown decreases by 1.

10 Communication and Vision

Each unit can only sense the objects (units, tiles, etc.) that are inside its vision radius. Vision is not shared. This means that objects detected by a given unit might not be detected by others.

Units run independently and they don't share memory. However, units can communicate using broadcasts. Whenever a unit broadcasts an integer, each other allied unit stores it in a buffer. Units can query the oldest message and clean the buffer (among other functionalities) using the methods provided in the *UnitController* class.

11 Energy

Energy is an approximate indicator of the number of basic instructions that each unit can perform during each round. More precisely, each bytecode instruction performed by a given unit consumes one unit of energy (except internal operations of the methods provided in the documentation, these consume a constant amount of bytecode which is specified there). For users not familiarized with Java, it is not necessary to know how bytecode works, however it is good to have in mind that it is somewhat proportional to the number of code instructions. The amount of energy consumed up to a certain instruction can be accessed at any time using the methods in *UnitController*. Whenever a unit surpasses the amount of energy allowed (currently set to 15000), the unit pauses and continues running the remaining instructions during its next turn.

12 User Instructions

Players must fill the *run* method of the *UnitPlayer* class, which is run independently by all units of the player's team. This function has a *UnitController* as input, which is used to give orders to the given unit/structure and to get information of the visible tiles, among others (check the documentation for more details).

Run does the following: Whenever a new unit is created, their *run* method is executed until either the unit finishes its turn by calling the *yield* method, or when it surpasses the amount of allowed energy. If a unit returns from its run method, it dies. Because of this it is suggested to keep its

instructions inside a *while(true)* statement, and to finish each iteration with a call to *yield* (check *nullplayer* and *demoplayer*).

13 Implementation Info

You may skip this section if you're not enough familiarized with Java.

Each unit is run in an independent thread. Each of these threads gets reactivated every time the unit is scheduled (once every round, following the same relative order every round). For safety reasons, it is forbidden to use any method or class outside *java/lang*, *java/math* and *java/util* (and some of the sub-classes of these). It is also forbidden to use static variables (which include switch statements, since they internally do so).

Even though codes that break these rules are automatically detected the instrumenter, we are going to check all the finalists' codes manually to be sure that everyone is playing a fair game. If a team breaks any of these rules without informing any of the devs, it will be disqualified.