

Partially reverse-engineered Fallout 2 combat algorithm

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This is a brief report on the progress made by Ghosthack and Atom during few days of reverse-engineering fallout2.exe. The formulas are exact (not extrapolated), taken directly from the executable. There is still much code in there yet to be understood, but we've already managed to extract the basic mechanics of critical failures in this manner.

Here's how single attack is resolved:

Assume that the ATTACKER is trying to attack a TARGET with a valid mode of attack. Let TOHIT be the displayed chance for a successful attack.

The following steps are carried out:

0. The pre-shooting phase:

This part isn't explored yet in any kind of detail. This is the moment when the TARGET can be changed to another potential target on the same line of fire. As it isn't known how the ingame mechanics handle the case of such a switch occurring we'll assume that it didn't and the ATTACKER had ultimately retained his original TARGET.

1. Basic attack resolution:

Let $RND = \text{Random}(1, 100)$. If $TOHIT - RND < 0$ then the attack was a miss, otherwise it was a hit. The same value of RND is then used to calculate if the attack was a critical one.

2a. If the attack was a hit:

There's a possibility of upgrading the "regular" hit to a critical hit.

Let CRITCHANCE be a total critical chance bonus (for the players it's a sum of Luck, the Finesse trait bonus which is either 0% or 10%, 5% for each level of More Criticals perk and aimed shooting to-hit penalty, why for the other critters it also depends on the stats from their .pro files).

The chance for a hit to be upgraded to a critical hit is then

$(CRITCHANCE + \text{Trunc}((TOHIT - RND)/10))\%$.

If this upgrade fails, then there's a second chance for the hit to upgrade depending on whether the player has picked the Slayer or Sniper perk and the type of the attack.

2b. If the attack was a miss:

There's a possibility of upgrading it to a critical miss, just as with the hits, and it equals

$\text{Trunc}((RND - TOHIT)/10)\%$.

The reason for RND and $TOHIT$ being in a reverse order is of course that of $TOHIT - RND$ being negative in this case. If the hit fails to upgrade but the ATTACKER is under the Jinxed effect (obtained from either the trait or the perk given by the pariah dog - their effects don't stack) there's a 50% chance for the miss being upgraded to a one critical anyway.

3. Assuming that the attack was a critical miss, as the critical hit effects are fairly well documented (and so are the generic hits and misses):

Let $ROLL = (\text{Random}(1, 100) - 5 \cdot (LK - 5))$. ROLL is compared with several thresholds to determine the position of the critical failure on the table (the critical hits are resolved in a similar manner but with a +0/+20 modifier depending on the Better Criticals perk instead of $-5 \cdot (LK - 5)$ depending on LK). The actual tables vary from weapon to weapon, but in general:

if

ROLL	≤	20	then	EFFECT = 0,	
20 <	ROLL	≤	50	then	EFFECT = 1,
50 <	ROLL	≤	75	then	EFFECT = 2,
75 <	ROLL	≤	95	then	EFFECT = 3,
95 <	ROLL			then	EFFECT = 4.

As one can see there are five possible critical miss effects. As a rule, the larger the value of EFFECT, the more severe it will be.

Remark: With $LK = 1$ it's impossible to get $EFFECT = 0$. With $LK > 5$ it's impossible to get $EFFECT = 4$. With $LK = 10$ it's impossible to get either $EFFECT = 3$ or $EFFECT = 4$.

There are seven tables used in determining what the actual effect of the critical miss will be. Those are:

- type0 for all unarmed weapons,
- type1 for all melee weapons,
- type2 for all small guns and all big guns except the rocket launcher and both flamers,
- type3 for all energy weapons,
- type4 for all grenades,
- type5 for the rocket launcher,
- type6 for the flamer and the improved flamer.

The actual tables are:

type0 (all unarmed)	
EFFECT	effects
0	miss
1	lost next turn
2	lost next turn
3	took %d damage, knocked down, hurt self
4	crippled random limb (NOT the eyes)

type1 (all melee)	
EFFECT	effects
0	miss
1	lost next turn
2	weapon dropped
3	hit randomly
4	took %d damage, hit self

type2 (all small guns and all big guns except the rocket launcher and the flamers)	
EFFECT	effects
0	miss
1	lost rest of ammo
2	weapon dropped
3	hit randomly
4	weapon destroyed

type3 (all energy weapons)	
EFFECT	effects
0	lost next turn
1	lost next turn, lost rest of ammo
2	lost next turn, weapon dropped
3	hit randomly
4	took %d damage, weapon exploded, lost next turn

type4 (all grenades)	
EFFECT	effects
0	fired dud shot
1	weapon dropped
2	took %d damage, weapon dropped, hurt self
3	hit randomly
4	took %d damage, weapon exploded

type5 (rocket launcher)	
EFFECT	effects
0	lost next turn
1	fired dud shot
2	weapon destroyed
3	hit randomly
4	took %d damage, knocked down, weapon exploded, lost next turn

type6 (flamers)	
EFFECT	effects
0	miss
1	lost next turn
2	hit randomly
3	weapon destroyed
4	took %d damage, on fire, weapon exploded, lost next turn

Remarks:

- In general, the effect types are written in the order in which they appear in the combat log.
- The "miss" effect behaves like a normal miss, no "critically missed" message is displayed.
- As for the "took %d damage", this is yet to be tested, but the following is conjectured:
for dropped grenades the damage received is the same as in type0/effect 3 while in the other cases the damage depends on the type of weapon used, most probably the damage being equal to one received by simply being shot by that weapon or its explosion in case of the grenades. It is not known if these damages can pierce armor.
- "on fire" in the last effect in type6 triggers the flamedance animation.
- First two effects in type5 seem to be bugged, as "fired a dud shot" is less severe than "lost next turn".
- The exact behavior of "hit randomly" is not fully known. With this effect it is possible to hit another target on the map instead of the original one (this is the second instance where the final shot receiver can be changed - the first was in the pre-shooting phase). Also, sometimes just a "hit randomly" message can be displayed, most commonly when there were no valid targets. It's not known if these redirected shots can be upgraded to critical hits.
- The "miss" effect in type6 can still cause damage to the target - as is the case of every missed shot with a flamer.