Date:

④ Block size (B) = 1024 bytes
Total block (N) = 8192 bytes
Max inodes (I) = 1024 bytes
Max filename = 60 characters
Direct ptrs = 20 pointers
fs magic = 0x47525345 "GRSF"

disk size = Block size x Total Block
= B x N = 1024 x 8192
= 8388608 bytes (8 MB)

superblock structure fixed size
uint32 magic : 4 bytes
block size : 4 bytes
total blocks : 4 bytes
free blocks : 4 bytes
total inodes : 4 bytes
free inodes : 4 bytes
inode table block : 4 bytes
block bitmap block : 4 bytes
data block start : 4 bytes

∴ total fixed fields : 9 x 4 bytes : 36 bytes

// Reserved space
Reserved space = 1024 - 36 = 988 bytes

Date:

superblock Memory layout:
[0-3] : magic
[4-7] : block_size
[8-11] : total_blocks
[12-15] : free_blocks
[16-19] : total_inodes
[20-23] : free_inodes
[24-27] : inode_table_block
[28-31] : block_bitmap_block
[32-35] : data_block_start
[36-1023] : reserved (988 bytes)

① Inode field sizes
id = 4 bytes
size = 4 bytes
direct[20] : 20 × 4 bytes = 80 bytes
parent = 4 bytes
is_dir = 1 byte
used = 1 byte

subtotal before padding = 4+4+80+4+1+1
= 94 bytes

② Padding calculation
Name offset = 128 bytes
bytes used before name = 94 bytes
padding needed = 128 - 94 = 34 bytes

Date:

Inode_PREFIX_BYTES = sizeof(uint32) + sizeof(uint32) + (sizeof(uint32) * DIRECT_PTRS) + sizeof(uint32) + sizeof(uint8) + sizeof(uint8)

= 4+4+(4×20)+4+1+1

= 94 bytes

Inode_PADDING_BYTES = INODE_NAME_OFFSET

= INODE_PREFIX_BYTES

= 128 - 94 = 34 bytes

○ name field

name[max_filename] : 60 bytes

Total Inode size:

94 bytes (fields) + 34 bytes (padding) + 60 bytes (name) = 188 bytes

○ Bitmap size calculation

Total_blocks = 8192 blocks

bits_needed = 8192 bits

Bytes_needed = ceil(8192/8)

= ceil(1024)

= 1024 bytes

BITMAP_size = (8192+7)/8

= 1024.875

= 1024 (integer division)

Date :

- Bitmap size in blocks
  Bitmap bytes = 1024 bytes
  Blocks needed = ceil(1024/1024)
  = 1 Block

- Inode Table size
  Inode size = 188 bytes
  MAX_INODES = 1024
  Total inode table bytes = 188 × 1024
  = 192512 bytes
  Blocks needed = ceil(192512/1024)
  = ceil(188)
  = 188 blocks

④ Block Assignment

Block 0 : SuperBlock (1 block)
Block 1 : start of inode table
Inode table uses 188 blocks
→ block 1 through 188

Block 189 : bitmap (1 block)
Block 190 : first data block

⑤ Free space calculation
Total blocks = 8192
Metadata blocks used = 190 blocks
data blocks available = 8192 − 190
= 8002 blocks