Monte Carlo Exercise

**Scenario: Estimating Well Duration**

You are planning to drill a well and need to build a time estimate for the well duration based on uncertain drilling operations, weather, and unexpected nonproductive time. Since all these factors vary, we will use a Monte Carlo simulation to model different outcomes. We will be using 100% probability for all events for simplicity.

**Step 1: Define the Variables**

We assume:

1. **Meeting time (M):** The time of the planning meeting in hours (deterministic).
2. **M/U BHA (B)** The BHA operations in hours (random).
3. **Drilling (D):** The drilling time in hours (random).
4. **Work String Free (S):** The time working the string free in hours (random).
5. **Cut Pipe (C):** The time cutting pipe and fishing in hours (random).
6. **POOH (P):** The time pulling out of hole in hours (random).
7. **Waiting on Weather (W):** The time spent waiting on weather to clear (deterministic).
8. **Nonproductive Time (N):** Nonproductive time (random).

**Step 2: Assign Probability**

We assume:

1. **Meeting time (M) 🡪 2 hours**
2. **M/U BHA (B)** **🡪 6,8,16 hours**
3. **Drilling (D) 🡪 30,40,60 hours**
4. **Work String Free (S) 🡪 0,1,2 hours**
5. **Cut Pipe (C) 🡪 3,6 hours**
6. **POOH (P) 🡪 2,4,9 hours**
7. **Waiting on Weather (W) 🡪 10 hours**
8. **Nonproductive Time (N) 🡪 6,12 hours**

**Step 3: Generate Random Samples (Simulating 10 Trials)**

To generate randomness, we use **dice**:

* Roll a **6-sided die** for **M/U BHA (B)**
  + **1-2 → 6 hours**
  + **3-4 → 8 hours**
  + **5-6 → 16 hours**
* Roll a **6-sided die** for **Drilling (D)**
  + **1-2 → 30 hours**
  + **3-4 → 40 hours**
  + **5-6 → 60 hours**
* Roll a **6-sided die** for **Work String Free (S)**
  + **1-3 → 0 hours**
  + **4-5 → 1 hour**
  + **6 → 2 hours**
* Roll a **6-sided die** for **Cut Pipe (C)**
  + **1-3 → 3 hours**
  + **4-6 → 6 hours**
* Roll a **6-sided die** for **POOH (P)**
  + **1-2 → 2 hours**
  + **3-4 → 4 hours**
  + **5-6 → 9 hours**
* Roll a **6-sided die** for **Nonproductive Time (N)**
  + **1-3 → 6 hours**
  + **4-6 → 12 hours**

**Step 4: Perform Multiple Trials**

We manually simulate **11 trials** using dice rolls.

**Step 5: Analyze Results**

* **Best Case (Lowest):**
  + **Trial 4** → **69 hours**
* **Worst Case (Highest):**
  + **Trial 7**→ **117 hours**
* **Risk Assessment:**
  + 10 out of 11 trials had durations under **100 hours**
  + Only **one trial** resulted in a duration of over **100 hours.**

**Step 6: Decision Making**

Based on this simulation:

* The **expected duration is under 100 hours.**