

Chamu_5661-Project_R_model

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Valuation of Caps using Black model and LIBOR/Monte Carlo

Caps and Floors are counterparts to Call and Put options in equity market used for hedging floating rate risk. They set the minimum return levels on one side of interest rate movement and allow the profit on the other side.

#These inputs can be modified

```
N <- 1000000          # Notional
n_sim <- 100000        # number of Monte carlo simulation
tau <- 0.5             # frequency of cap/floor or  $\delta$ 
sigma <- 0.15          # volatility
K <- 0.05              # strike rate
n <- 4                 # number of forwards excluding  $f_0$ 
f <- 0.05              # forward rate
```

A caplet is a call option on the zero-coupon yield prevailing at time $t_i - \delta$ for a period of length δ , but where the payment takes place at time t_i although it is already fixed at time $t_i - \delta$

Calculating **discount factor** used for both models

```
t <- seq(0, n * tau, tau)
forward <- matrix(NA, n + 1, n + 1)
forward[, 1] <- f

Discount <- function(tau, forward){
  discount <- 1 / (1 + tau * forward)
  discount[is.na(forward)] <- 1
  for (i in 2 : (n + 1)){
    discount[i, ] <- discount[i, ] * discount[i - 1, ]
  }
  discount[is.na(forward)] <- NA
  return(discount)
}

discount <- Discount(tau = tau, forward = forward)
```

Black Model : Assumptions are as below • Underlying forward rate or swap rate is log normally distributed • volatility of the underlying is constant • Prices are arbitrage free • There is continuous trading in all instruments

```
cap <- function(){
  v <- sigma * sqrt(t[2 : (n + 1)])
  d1 <- (log(forward[2 : (n + 1), 1] / K) + 1/2 * v ^ 2) / v
  d2 <- (log(forward[2 : (n + 1), 1] / K) - 1/2 * v ^ 2) / v

  cap <- N * discount[2 : (n + 1), 1] * tau *
    (forward[2 : (n + 1), 1] * pnorm(d1) - K * pnorm(d2))
}
Caplets <- cap()
```

LIBOR market model using Monte Carlo method:

The basic idea behind a market model is to model interest rates directly observable in the market, which are the forward LIBOR rates in the case of the LIBOR market model (As opposed to instantaneous short rates in short rate models or instantaneous forward rates in the HJM framework, which are mathematical abstractions).

Similar to the Black-76 model the LIBOR market model assumes a log-normal process for each forward LIBOR rate under the T_i -forward measure.

```
# update Forward rate
MC <- function(){
  DW <- sqrt(tau) * qnorm(runif(n, 0, 1))
  LMMDrift <- function(forward, j){
    if (j <= n){
      temp <- sapply(j : n, function(k) sum(forward[k : n] / (1 + tau *
forward[k : n])))
      return(c(temp * tau * sigma ^ 2, 0))
    }
    return(0)
  }

  for (j in 2 : (n + 1)){
    forward[j : (n + 1), j] <- forward[j : (n + 1), j - 1] *
      exp((-LMMDrift(forward = forward[, j - 1], j) - 1/2 * sigma ^ 2) * tau
+ sigma * DW[j - 1])
  }

# update the Discount factor
  discount <- Discount(tau = tau, forward = forward)

  MC_raw_payoff <- pmax(diag(forward) - K, 0)[2 : (n + 1)]

# change Numeraire
  Change <- function(){
    temp1 <- diag(discount)[2 : (n + 1)]
    temp2 <- discount[2 : (n + 1), 1]
```

```

temp3 <- discount[(n + 1), 2 : (n + 1)]
temp4 <- discount[(n + 1), 1]

result <- MC_raw_payoff * (temp1 / temp2) / (temp3 / temp4)
}
# calculate corrected Payoff
MC_corrected_payoff <- Change()
result <- c(MC_raw_payoff, MC_corrected_payoff)
return(result)
}
result <- matrix(replicate(n_sim, MC()), n_sim, 2 * n, byrow = TRUE)
colnames(result) <- c(paste0('V', c(1 : n), '_RAW'),
                      paste0('V', c(1 : n), '_CORR'))

```

Comparison of two models:

```

construct_table <- function(){
  table <- matrix(NA, n + 1, 3)
  colnames(table) <- c('MC', 'Black', 'ERROR')
  rownames(table) <- c(paste0('Caplet', 1 : n), 'Cap')

  temp <- sapply(1 : n, function(i) mean(result[, n + i]))
  temp <- temp * tau * discount[2 : (n + 1), 1] * N
  table[1 : n, 1] <- temp
  table[1 : n, 2] <- Caplets
  table[n + 1, 1 : 2] <- colSums(table[1 : n, 1 : 2])
  table[, 3] <- (table[, 1] - table[, 2]) / table[, 2]
  return(table)
}
table <- construct_table()

```

In contrast to the Black model, LIBOR market model describes the dynamic of a whole family of **forward rates under a common measure**. By means of multivariate Girsanov's theorem one can switch between the different T-Forward measures.

Below is the comparison table and simulation results:

```

table

##           MC      Black      ERROR
## Caplet1 1005.981 1006.410 -0.0004264097
## Caplet2 1396.836 1387.915  0.0064280760
## Caplet3 1673.632 1657.605  0.0096688033
## Caplet4 1878.164 1866.480  0.0062601937
## Cap      5954.614 5918.410  0.0061171940

result

##           V1_RAW      V2_RAW      V3_RAW      V4_RAW      V1_CORR
## [1,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00

```

```
## [3,] 4.195409e-03 9.932272e-03 1.505569e-02 1.081312e-02 4.221404e-03
## [4,] 1.783942e-03 0.000000e+00 0.000000e+00 9.104328e-03 1.788678e-03
## [5,] 5.331228e-03 3.560326e-03 1.432386e-03 0.000000e+00 5.373167e-03
## [6,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [7,] 5.499203e-03 9.949037e-03 2.129718e-02 7.584798e-03 5.543824e-03
## [8,] 2.880113e-03 5.524142e-03 0.000000e+00 0.000000e+00 2.892392e-03
## [9,] 5.099921e-03 1.112086e-02 2.984838e-03 0.000000e+00 5.138305e-03
## [10,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [11,] 0.000000e+00 3.360076e-03 0.000000e+00 0.000000e+00 0.000000e+00
## [12,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [13,] 3.436313e-03 4.997491e-04 2.019753e-03 0.000000e+00 3.453771e-03
## [14,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [15,] 5.555256e-03 0.000000e+00 5.760697e-03 3.762356e-03 5.600790e-03
## [16,] 4.954358e-03 3.113965e-03 0.000000e+00 0.000000e+00 4.990585e-03
## [17,] 0.000000e+00 1.412096e-03 4.207984e-04 2.062414e-03 0.000000e+00
## [18,] 5.731182e-03 2.325135e-03 1.393551e-02 1.079495e-02 5.779642e-03
## [19,] 8.034944e-03 1.765235e-02 1.867843e-02 1.419679e-02 8.130171e-03
## [20,] 0.000000e+00 0.000000e+00 5.972908e-04 0.000000e+00 0.000000e+00
## [21,] 0.000000e+00 1.018250e-03 1.179085e-02 1.575568e-02 0.000000e+00
## [22,] 3.742974e-03 1.267702e-02 8.681469e-03 0.000000e+00 3.763676e-03
## [23,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [24,] 0.000000e+00 7.839757e-03 1.051703e-02 8.486217e-03 0.000000e+00
## [25,] 3.507840e-03 0.000000e+00 0.000000e+00 7.026520e-03 3.526029e-03
## [26,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [27,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [28,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [29,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [30,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [31,] 2.516358e-03 0.000000e+00 2.598262e-03 0.000000e+00 2.525743e-03
## [32,] 1.283012e-02 1.680016e-02 1.294348e-02 9.260279e-03 1.307318e-02
## [33,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [34,] 0.000000e+00 0.000000e+00 5.452947e-03 0.000000e+00 0.000000e+00
## [35,] 5.537846e-03 6.692249e-03 6.259912e-03 7.492331e-03 5.583096e-03
## [36,] 6.702372e-03 1.024520e-02 2.087877e-03 8.395796e-03 6.768634e-03
## [37,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [38,] 0.000000e+00 2.371008e-03 1.284363e-03 1.004875e-02 0.000000e+00
## [39,] 1.147028e-03 2.145911e-03 7.089286e-05 5.612930e-03 1.149002e-03
## [40,] 1.769092e-03 1.410571e-03 3.356649e-04 0.000000e+00 1.773750e-03
## [41,] 0.000000e+00 0.000000e+00 0.000000e+00 4.009523e-03 0.000000e+00
## [42,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [43,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [44,] 0.000000e+00 1.392977e-03 0.000000e+00 0.000000e+00 0.000000e+00
## [45,] 0.000000e+00 4.579371e-03 1.504379e-02 9.717359e-03 0.000000e+00
## [46,] 0.000000e+00 2.152733e-03 3.187400e-03 0.000000e+00 0.000000e+00
## [47,] 2.442628e-03 2.099774e-03 0.000000e+00 0.000000e+00 2.451473e-03
## [48,] 4.687168e-03 5.767147e-03 0.000000e+00 0.000000e+00 4.719599e-03
## [49,] 0.000000e+00 3.667813e-03 1.500654e-03 9.555332e-04 0.000000e+00
## [50,] 5.664603e-03 1.083048e-02 3.901976e-03 1.988563e-02 5.711945e-03
## [51,] 3.144833e-03 7.769502e-03 1.824794e-02 2.492448e-02 3.159463e-03
## [52,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
```

```
## [53,] 4.723398e-03 4.381569e-03 0.000000e+00 2.151753e-03 4.756332e-03
## [54,] 7.214161e-04 0.000000e+00 0.000000e+00 0.000000e+00 7.222074e-04
## [55,] 0.000000e+00 6.581214e-04 3.502344e-03 0.000000e+00 0.000000e+00
## [56,] 3.177748e-04 1.398818e-03 0.000000e+00 0.000000e+00 3.179355e-04
## [57,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [58,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [59,] 2.145899e-03 2.388351e-03 6.192234e-03 0.000000e+00 2.152735e-03
## [60,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [61,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [62,] 7.814097e-03 1.782134e-02 2.369016e-02 1.958762e-02 7.904160e-03
## [63,] 0.000000e+00 2.579406e-03 1.415925e-03 0.000000e+00 0.000000e+00
## [64,] 0.000000e+00 2.936474e-03 3.296330e-03 0.000000e+00 0.000000e+00
## [65,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [66,] 2.037643e-03 5.272399e-03 4.840792e-03 5.236525e-03 2.043811e-03
## [67,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [68,] 2.767053e-03 1.588508e-03 0.000000e+00 0.000000e+00 2.778391e-03
## [69,] 6.836094e-03 6.403492e-04 3.233935e-04 9.597728e-04 6.905025e-03
## [70,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [71,] 3.230859e-03 8.767267e-04 2.093266e-03 0.000000e+00 3.246297e-03
## [72,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [73,] 0.000000e+00 1.074707e-02 2.117419e-02 1.936688e-02 0.000000e+00
## [74,] 4.468579e-03 1.616442e-03 0.000000e+00 0.000000e+00 4.498061e-03
## [75,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [76,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [77,] 5.723183e-03 0.000000e+00 0.000000e+00 0.000000e+00 5.771509e-03
## [78,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [79,] 0.000000e+00 2.808764e-03 1.974977e-03 3.149031e-03 0.000000e+00
## [80,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [81,] 6.774815e-03 3.562644e-03 0.000000e+00 0.000000e+00 6.842517e-03
## [82,] 9.421180e-03 1.293464e-02 1.221925e-02 1.094576e-02 9.552122e-03
## [83,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [84,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [85,] 1.786180e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.790927e-03
## [86,] 1.721572e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.725984e-03
## [87,] 0.000000e+00 0.000000e+00 0.000000e+00 6.818014e-03 0.000000e+00
## [88,] 8.758470e-03 5.868089e-03 2.145561e-03 0.000000e+00 8.871627e-03
## [89,] 1.859886e-03 5.832807e-03 3.486489e-03 1.042910e-04 1.865031e-03
## [90,] 1.534033e-04 3.638759e-03 1.130342e-02 1.089244e-02 1.534439e-04
## [91,] 4.719906e-03 5.080446e-03 5.282226e-03 1.770042e-02 4.752791e-03
## [92,] 7.582108e-03 8.832923e-03 2.189835e-02 2.473848e-02 7.666902e-03
## [93,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [94,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [95,] 0.000000e+00 2.022395e-03 9.588619e-04 0.000000e+00 0.000000e+00
## [96,] 0.000000e+00 0.000000e+00 0.000000e+00 5.721160e-04 0.000000e+00
## [97,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [98,] 1.506037e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.509421e-03
## [99,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [100,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [101,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [102,] 0.000000e+00 0.000000e+00 0.000000e+00 8.684728e-04 0.000000e+00
```

```
## [103,] 0.000000e+00 0.000000e+00 0.000000e+00 1.617326e-03 0.000000e+00
## [104,] 1.873126e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.878343e-03
## [105,] 4.971501e-03 4.692183e-03 2.998131e-03 0.000000e+00 5.007979e-03
## [106,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [107,] 1.968665e-03 5.032878e-03 7.645753e-03 4.684410e-03 1.974424e-03
## [108,] 0.000000e+00 4.391283e-03 1.106043e-02 1.286916e-02 0.000000e+00
## [109,] 0.000000e+00 6.324646e-03 1.288444e-02 1.626127e-02 0.000000e+00
## [110,] 2.145109e-02 1.555993e-02 1.362744e-02 1.407763e-02 2.213281e-02
## [111,] 9.500195e-04 4.072110e-03 0.000000e+00 0.000000e+00 9.513799e-04
## [112,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [113,] 0.000000e+00 0.000000e+00 3.233654e-03 7.134254e-03 0.000000e+00
## [114,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [115,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [116,] 0.000000e+00 3.543680e-03 8.008941e-03 5.882167e-03 0.000000e+00
## [117,] 5.019967e-05 1.697117e-03 1.141607e-02 1.070925e-02 5.020537e-05
## [118,] 9.060752e-04 0.000000e+00 1.274131e-03 3.875619e-03 9.073142e-04
## [119,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [120,] 1.316068e-02 1.197718e-02 1.042848e-02 0.000000e+00 1.341646e-02
## [121,] 0.000000e+00 4.419516e-03 9.917269e-03 9.106678e-03 0.000000e+00
## [122,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [123,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [124,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [125,] 5.534703e-04 0.000000e+00 0.000000e+00 0.000000e+00 5.539412e-04
## [126,] 6.836078e-03 0.000000e+00 0.000000e+00 0.000000e+00 6.905009e-03
## [127,] 5.774646e-03 1.583228e-02 1.567838e-02 2.149983e-02 5.823844e-03
## [128,] 4.952468e-03 5.896357e-03 1.198296e-03 0.000000e+00 4.988668e-03
## [129,] 2.052757e-03 1.426783e-02 2.771923e-02 2.527165e-02 2.059016e-03
## [130,] 0.000000e+00 5.844447e-03 1.943949e-03 6.576556e-03 0.000000e+00
## [131,] 4.677387e-03 1.918921e-03 0.000000e+00 4.622148e-03 4.709683e-03
## [132,] 8.863514e-03 6.952200e-03 1.251179e-02 1.076953e-02 8.979403e-03
## [133,] 1.690351e-03 0.000000e+00 0.000000e+00 4.024537e-03 1.694606e-03
## [134,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [135,] 1.872436e-03 9.031339e-04 0.000000e+00 0.000000e+00 1.877650e-03
## [136,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [137,] 0.000000e+00 0.000000e+00 6.000840e-03 0.000000e+00 0.000000e+00
## [138,] 1.448057e-03 0.000000e+00 9.286537e-03 1.306937e-02 1.451187e-03
## [139,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [140,] 1.116497e-03 1.340424e-03 7.971179e-03 7.004577e-03 1.118368e-03
## [141,] 2.076412e-04 7.444106e-04 5.421129e-03 5.838204e-03 2.077127e-04
## [142,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [143,] 5.576378e-03 0.000000e+00 0.000000e+00 6.274092e-04 5.622259e-03
## [144,] 2.282090e-03 3.336142e-03 3.070186e-03 1.836219e-03 2.289816e-03
## [145,] 3.598738e-03 3.945450e-03 5.832513e-03 1.367383e-02 3.617880e-03
## [146,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [147,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [148,] 0.000000e+00 0.000000e+00 2.753852e-03 0.000000e+00 0.000000e+00
## [149,] 0.000000e+00 4.068517e-03 1.456686e-02 1.355095e-02 0.000000e+00
## [150,] 5.806199e-03 1.321149e-02 2.124419e-02 9.224532e-03 5.855935e-03
## [151,] 0.000000e+00 2.176128e-03 0.000000e+00 0.000000e+00 0.000000e+00
## [152,] 0.000000e+00 0.000000e+00 2.756667e-03 4.154811e-04 0.000000e+00
```

```
## [153,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [154,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [155,] 0.000000e+00 1.803146e-03 0.000000e+00 0.000000e+00 0.000000e+00
## [156,] 3.772080e-03 0.000000e+00 0.000000e+00 0.000000e+00 3.793104e-03
## [157,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [158,] 6.391648e-04 9.539998e-04 1.459987e-03 3.681563e-03 6.397889e-04
## [159,] 0.000000e+00 0.000000e+00 2.993986e-04 0.000000e+00 0.000000e+00
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## [162,] 0.000000e+00 4.908112e-03 1.239991e-02 2.430220e-02 0.000000e+00
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## [171,] 1.172401e-02 1.003042e-02 2.192461e-02 5.164472e-03 1.192691e-02
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## [752,] 0.000000e+00 4.979929e-04 2.351043e-03 1.976245e-03 0.000000e+00
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## [757,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [759,] 0.000000e+00 0.000000e+00 0.000000e+00 1.927146e-03 0.000000e+00
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## [960,] 6.847956e-03 6.991163e-03 1.258599e-02 1.221981e-02 6.917126e-03
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## [970,] 0.000000e+00 0.000000e+00 0.000000e+00 1.338412e-03 0.000000e+00
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## [1144,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1146,] 1.110957e-02 1.076543e-02 8.675585e-03 9.288030e-03 1.129172e-02
## [1147,] 1.057920e-03 2.717591e-03 0.000000e+00 0.000000e+00 1.059602e-03
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## [1149,] 0.000000e+00 5.660702e-04 0.000000e+00 0.000000e+00 0.000000e+00
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## [1151,] 2.433475e-03 1.147588e-02 5.097009e-03 6.296706e-03 2.442254e-03
## [1152,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1155,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1158,] 7.196289e-03 8.672735e-03 8.563352e-03 5.509089e-03 7.272674e-03
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## [1160,] 9.311556e-03 1.346787e-02 1.568113e-02 1.240117e-02 9.439467e-03
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## [1163,] 1.359122e-02 2.166676e-02 1.401167e-02 1.077870e-02 1.386404e-02
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## [1165,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1343,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1347,] 0.000000e+00 1.970397e-03 1.360602e-02 1.854252e-02 0.000000e+00
## [1348,] 5.935492e-05 1.381959e-02 1.042419e-02 1.381481e-02 5.936246e-05
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## [1350,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1550,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1552,] 0.000000e+00 1.487823e-03 0.000000e+00 0.000000e+00 0.000000e+00
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## [1560,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1734,] 0.000000e+00 3.612949e-03 8.924781e-03 1.073371e-02 0.000000e+00
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## [1738,] 0.000000e+00 1.886929e-03 2.195605e-03 1.545486e-03 0.000000e+00
## [1739,] 1.522450e-02 1.915684e-02 2.287745e-02 3.775003e-02 1.556704e-02
## [1740,] 1.094764e-02 8.977562e-03 1.553179e-02 2.366439e-02 1.112451e-02
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## [1748,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1763,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1919,] 2.163903e-03 0.000000e+00 0.000000e+00 0.000000e+00 2.170853e-03
## [1920,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1921,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1922,] 0.000000e+00 5.038228e-03 4.560925e-03 8.775383e-03 0.000000e+00
## [1923,] 0.000000e+00 0.000000e+00 9.882209e-04 8.789451e-03 0.000000e+00
## [1924,] 1.593029e-03 4.806290e-03 8.982352e-03 8.883335e-03 1.596812e-03
## [1925,] 4.499026e-04 0.000000e+00 0.000000e+00 0.000000e+00 4.502171e-04
## [1926,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1927,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1928,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1929,] 2.408376e-03 2.601519e-03 0.000000e+00 0.000000e+00 2.416976e-03
## [1930,] 1.102938e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.104765e-03
## [1931,] 1.366744e-03 7.227826e-03 1.507032e-02 1.823468e-02 1.369536e-03
## [1932,] 0.000000e+00 6.997419e-04 0.000000e+00 0.000000e+00 0.000000e+00
## [1933,] 1.971723e-03 3.934434e-03 4.462054e-03 4.287857e-03 1.977501e-03
## [1934,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1935,] 1.887072e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.892367e-03
## [1936,] 0.000000e+00 0.000000e+00 0.000000e+00 6.205339e-04 0.000000e+00
## [1937,] 0.000000e+00 0.000000e+00 5.858228e-03 0.000000e+00 0.000000e+00
## [1938,] 1.274620e-02 2.278165e-02 1.718948e-02 1.715413e-02 1.298609e-02
## [1939,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1940,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1941,] 0.000000e+00 6.832678e-03 9.693379e-03 5.802703e-03 0.000000e+00
## [1942,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [1943,] 3.375210e-03 2.897645e-03 1.176106e-02 1.827040e-03 3.392054e-03
## [1944,] 0.000000e+00 7.729264e-03 7.154828e-03 1.928255e-02 0.000000e+00
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## [1946,] 0.000000e+00 0.000000e+00 2.286918e-03 1.810785e-03 0.000000e+00
## [1947,] 5.212599e-03 1.278029e-02 3.909763e-03 1.502257e-03 5.252696e-03
## [1948,] 3.287657e-03 1.087933e-02 5.467475e-03 9.039066e-03 3.303641e-03
## [1949,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1951,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1955,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1957,] 3.660005e-03 2.009026e-03 3.043878e-03 1.093606e-02 3.679802e-03
## [1958,] 1.096975e-03 2.661122e-03 3.083746e-03 0.000000e+00 1.098782e-03
## [1959,] 4.362226e-03 4.814397e-04 0.000000e+00 5.451473e-03 4.390324e-03
## [1960,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1963,] 3.670857e-03 6.952173e-03 5.219948e-03 3.945434e-03 3.690771e-03
## [1964,] 0.000000e+00 5.513965e-03 3.681471e-03 1.426907e-02 0.000000e+00
## [1965,] 1.992843e-03 0.000000e+00 3.117435e-03 0.000000e+00 1.998744e-03
## [1966,] 0.000000e+00 0.000000e+00 1.150627e-03 3.837530e-05 0.000000e+00
## [1967,] 5.057630e-04 0.000000e+00 0.000000e+00 0.000000e+00 5.061579e-04
## [1968,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [1971,] 2.878106e-03 0.000000e+00 0.000000e+00 0.000000e+00 2.890368e-03
## [1972,] 1.371186e-04 0.000000e+00 0.000000e+00 0.000000e+00 1.371516e-04
## [1973,] 0.000000e+00 0.000000e+00 2.455316e-03 2.811777e-03 0.000000e+00
## [1974,] 8.994001e-03 3.116618e-03 1.547755e-03 0.000000e+00 9.113330e-03
## [1975,] 7.093853e-05 0.000000e+00 0.000000e+00 0.000000e+00 7.094874e-05
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## [1998,] 7.260643e-03 1.187236e-02 1.286104e-02 1.421246e-02 7.338400e-03
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## [2002,] 9.376879e-03 9.995618e-03 1.066143e-02 2.020398e-02 9.506592e-03
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## [2005,] 0.000000e+00 0.000000e+00 0.000000e+00 3.229020e-03 0.000000e+00
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## [2012,] 0.000000e+00 0.000000e+00 3.233205e-03 1.771445e-03 0.000000e+00
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## [2016,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2017,] 5.011760e-03 1.102020e-02 8.690458e-03 6.497695e-03 5.048831e-03
## [2018,] 0.000000e+00 4.778173e-03 0.000000e+00 0.000000e+00 0.000000e+00
## [2019,] 6.246084e-03 2.237239e-02 2.235415e-02 2.425397e-02 6.303635e-03
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## [2021,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2024,] 3.392873e-03 1.063598e-02 9.152140e-03 8.000971e-03 3.409893e-03
## [2025,] 2.140931e-03 5.264421e-03 0.000000e+00 0.000000e+00 2.147736e-03
## [2026,] 2.124323e-03 0.000000e+00 9.408309e-04 4.371313e-03 2.131023e-03
## [2027,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2030,] 4.425240e-03 1.024336e-02 8.266705e-03 4.207035e-03 4.454154e-03
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## [2035,] 4.992909e-03 8.664159e-03 8.521820e-03 1.794241e-02 5.029701e-03
## [2036,] 0.000000e+00 0.000000e+00 1.238020e-02 1.338090e-02 0.000000e+00
## [2037,] 1.513309e-02 1.371602e-02 7.885146e-03 8.593513e-03 1.547151e-02
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## [2040,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2042,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2043,] 5.907394e-03 1.557122e-02 9.836735e-03 1.711692e-02 5.958878e-03
## [2044,] 5.830798e-03 2.263976e-03 1.027148e-02 1.459663e-02 5.880956e-03
## [2045,] 0.000000e+00 2.719098e-03 7.002898e-03 9.914057e-03 0.000000e+00
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## [2067,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2086,] 1.368202e-02 1.631557e-02 5.208676e-03 1.689618e-03 1.395850e-02
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## [2113,] 0.000000e+00 0.000000e+00 7.438022e-03 4.816832e-03 0.000000e+00
## [2114,] 9.122717e-03 1.989772e-03 2.435698e-03 1.958168e-02 9.245488e-03
## [2115,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2116,] 0.000000e+00 0.000000e+00 6.624492e-03 9.736090e-03 0.000000e+00
## [2117,] 2.360153e-03 4.355636e-03 2.222141e-05 0.000000e+00 2.368413e-03
## [2118,] 4.447997e-04 3.457843e-03 1.091404e-02 1.706283e-02 4.451073e-04
## [2119,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2121,] 1.948506e-03 7.878433e-03 9.927633e-03 2.133613e-03 1.954148e-03
## [2122,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2123,] 0.000000e+00 0.000000e+00 1.539249e-03 0.000000e+00 0.000000e+00
## [2124,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2125,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2127,] 2.260435e-03 0.000000e+00 0.000000e+00 1.810757e-03 2.268016e-03
## [2128,] 1.477048e-04 3.022221e-03 0.000000e+00 0.000000e+00 1.477426e-04
## [2129,] 0.000000e+00 0.000000e+00 8.578481e-05 3.710448e-03 0.000000e+00
## [2130,] 5.045251e-03 9.548471e-05 8.376570e-03 8.091173e-03 5.082818e-03
## [2131,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2134,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2136,] 0.000000e+00 2.967724e-03 5.103410e-04 6.444245e-03 0.000000e+00
## [2137,] 4.487467e-03 7.144973e-03 1.816778e-02 2.611463e-02 4.517198e-03
## [2138,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2140,] 6.485998e-03 2.524203e-03 0.000000e+00 0.000000e+00 6.548052e-03
## [2141,] 3.376563e-03 6.804576e-03 1.276733e-02 1.635019e-02 3.393420e-03
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## [2152,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2153,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2156,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2161,] 8.056312e-03 1.616386e-02 1.264218e-02 1.412606e-02 8.152046e-03
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## [2169,] 0.000000e+00 0.000000e+00 1.035239e-02 1.065057e-02 0.000000e+00
## [2170,] 7.447875e-03 1.884692e-02 2.249370e-02 3.090195e-02 7.529694e-03
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## [2177,] 6.708063e-03 1.363866e-02 2.065918e-02 2.286770e-02 6.774437e-03
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## [2201,] 5.234672e-03 4.684989e-03 5.172426e-03 2.819902e-03 5.275108e-03
## [2202,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2206,] 2.196061e-03 1.318438e-02 2.485109e-02 3.802534e-03 2.203219e-03
## [2207,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2208,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2211,] 9.325233e-03 1.905655e-02 2.042334e-02 2.377923e-02 9.453520e-03
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## [2213,] 0.000000e+00 3.775340e-03 8.142137e-03 6.269366e-03 0.000000e+00
## [2214,] 6.804867e-03 9.424806e-03 9.547160e-03 5.543429e-03 6.873170e-03
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## [2219,] 4.176874e-05 3.835206e-03 7.454672e-03 2.191814e-03 4.177297e-05
## [2220,] 7.066243e-04 4.096128e-03 1.113038e-02 1.390466e-02 7.073840e-04
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## [2226,] 0.000000e+00 0.000000e+00 0.000000e+00 4.268679e-03 0.000000e+00
## [2227,] 0.000000e+00 4.002192e-04 0.000000e+00 0.000000e+00 0.000000e+00
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## [2232,] 1.929557e-03 7.922667e-03 9.606199e-03 9.667921e-03 1.935092e-03
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## [2234,] 3.239356e-03 6.934262e-03 4.921410e-03 0.000000e+00 3.254875e-03
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## [2239,] 0.000000e+00 0.000000e+00 8.170980e-03 0.000000e+00 0.000000e+00
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## [2244,] 0.000000e+00 1.626838e-03 6.396293e-03 4.807839e-03 0.000000e+00
## [2245,] 0.000000e+00 0.000000e+00 2.571276e-03 4.930082e-03 0.000000e+00
## [2246,] 3.979010e-03 3.842820e-04 0.000000e+00 0.000000e+00 4.002398e-03
## [2247,] 3.013455e-03 1.079166e-02 6.160297e-03 1.106941e-02 3.026893e-03
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## [2252,] 0.000000e+00 0.000000e+00 3.314302e-03 2.768567e-03 0.000000e+00
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## [2502,] 3.853314e-03 3.078806e-03 6.833304e-04 1.241118e-03 3.875251e-03
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## [2516,] 8.433084e-04 6.869131e-03 1.234477e-02 7.769033e-03 8.443841e-04
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## [2692,] 7.610086e-03 9.614375e-03 0.000000e+00 2.087101e-03 7.695508e-03
## [2693,] 5.076805e-03 3.024612e-03 0.000000e+00 0.000000e+00 5.114842e-03
## [2694,] 6.019235e-03 1.074199e-02 1.359011e-02 1.018826e-02 6.072685e-03
## [2695,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2696,] 1.165280e-02 2.957816e-03 5.638983e-03 1.927413e-03 1.185323e-02
## [2697,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2698,] 1.786262e-04 6.464676e-03 2.821104e-04 6.524028e-03 1.786801e-04
## [2699,] 1.707700e-03 2.330502e-03 0.000000e+00 9.424935e-03 1.712043e-03
## [2700,] 2.757370e-03 8.506308e-03 2.601751e-02 3.041010e-02 2.768628e-03
## [2701,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2702,] 0.000000e+00 0.000000e+00 3.028086e-03 1.240566e-02 0.000000e+00
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## [2703,] 1.102512e-02 1.507572e-02 1.030808e-02 1.463950e-02 1.120451e-02
## [2704,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2705,] 1.080511e-02 1.271164e-02 6.665686e-03 8.569798e-04 1.097739e-02
## [2706,] 1.490683e-03 0.000000e+00 3.411344e-03 0.000000e+00 1.493999e-03
## [2707,] 7.450165e-03 1.425375e-02 2.169439e-02 2.969480e-02 7.532034e-03
## [2708,] 4.001106e-03 2.303803e-03 0.000000e+00 0.000000e+00 4.024753e-03
## [2709,] 6.731049e-03 9.262359e-03 1.643023e-02 1.506069e-02 6.797879e-03
## [2710,] 4.519352e-03 0.000000e+00 1.659740e-03 1.149603e-03 4.549507e-03
## [2711,] 3.866296e-03 1.237183e-04 8.781146e-04 0.000000e+00 3.888380e-03
## [2712,] 2.085944e-03 8.660680e-04 0.000000e+00 0.000000e+00 2.092406e-03
## [2713,] 3.547118e-03 1.890052e-02 3.340031e-02 3.847366e-02 3.565715e-03
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## [2715,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2716,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2717,] 3.627520e-03 3.430177e-03 5.742190e-03 3.853536e-03 3.646968e-03
## [2718,] 1.306782e-04 5.883768e-03 2.048151e-03 3.467709e-03 1.307085e-04
## [2719,] 1.094292e-03 0.000000e+00 0.000000e+00 0.000000e+00 1.096090e-03
## [2720,] 0.000000e+00 1.851983e-04 3.424697e-03 1.267833e-02 0.000000e+00
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## [2725,] 1.371096e-02 1.220048e-02 5.015358e-04 0.000000e+00 1.398863e-02
## [2726,] 0.000000e+00 0.000000e+00 0.000000e+00 6.232395e-04 0.000000e+00
## [2727,] 7.609904e-03 2.009647e-03 4.384864e-03 0.000000e+00 7.695321e-03
## [2728,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2751,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2752,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2784,] 3.238449e-03 1.032656e-03 1.112389e-03 6.196550e-03 3.253960e-03
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## [2787,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2790,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2797,] 0.000000e+00 1.422293e-05 0.000000e+00 0.000000e+00 0.000000e+00
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## [2801,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2805,] 1.808677e-03 6.162542e-03 1.133238e-02 1.522674e-02 1.813544e-03
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## [2807,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2809,] 0.000000e+00 5.124412e-04 0.000000e+00 9.766053e-04 0.000000e+00
## [2810,] 1.026533e-04 7.497917e-04 4.456814e-03 5.409755e-03 1.026729e-04
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## [2814,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2816,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2823,] 0.000000e+00 0.000000e+00 9.269898e-04 2.134274e-03 0.000000e+00
## [2824,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2827,] 0.000000e+00 0.000000e+00 0.000000e+00 4.155951e-03 0.000000e+00
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## [2830,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2842,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2845,] 4.846919e-03 2.317046e-03 2.949234e-03 1.093555e-02 4.881594e-03
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## [2887,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [2888,] 4.805944e-03 1.086361e-02 1.079790e-02 1.082819e-02 4.840036e-03
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## [2892,] 0.000000e+00 0.000000e+00 0.000000e+00 1.705319e-03 0.000000e+00
## [2893,] 0.000000e+00 1.908613e-03 4.936965e-04 0.000000e+00 0.000000e+00
## [2894,] 2.212743e-03 8.975274e-03 7.262465e-03 0.000000e+00 2.220009e-03
## [2895,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2898,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2900,] 4.409900e-03 4.508504e-03 7.894226e-03 0.000000e+00 4.438614e-03
## [2901,] 0.000000e+00 8.740801e-03 1.744915e-02 2.936868e-02 0.000000e+00
## [2902,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [2908,] 3.696000e-03 3.258438e-03 1.707507e-03 1.090303e-03 3.716187e-03
## [2909,] 8.576664e-03 1.475829e-02 2.471054e-02 3.825538e-02 8.685170e-03
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## [2922,] 1.424282e-02 5.957804e-03 9.339901e-03 9.192449e-03 1.454250e-02
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## [2926,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [3080,] 9.003082e-03 1.067398e-02 1.877430e-02 4.352108e-02 9.122652e-03
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## [3087,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [3093,] 4.213024e-03 0.000000e+00 0.000000e+00 0.000000e+00 4.239236e-03
## [3094,] 3.483507e-03 1.554432e-03 1.800010e-03 6.365420e-03 3.501446e-03
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## [3098,] 5.561685e-03 2.253994e-03 2.286785e-03 4.682239e-03 5.607325e-03
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## [3101,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [3111,] 5.582855e-03 4.983825e-03 6.951542e-03 1.705809e-02 5.628842e-03
## [3112,] 9.863445e-03 5.724123e-03 5.108159e-03 3.404215e-03 1.000698e-02
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## [3274,] 6.988717e-03 1.812802e-02 1.483840e-02 7.303794e-03 7.060760e-03
## [3275,] 0.000000e+00 5.398204e-03 1.523656e-02 2.435160e-02 0.000000e+00
## [3276,] 8.069362e-04 0.000000e+00 0.000000e+00 0.000000e+00 8.079224e-04
## [3277,] 1.734588e-04 0.000000e+00 1.203787e-03 0.000000e+00 1.735099e-04
## [3278,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [3293,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [3295,] 4.495491e-03 0.000000e+00 0.000000e+00 0.000000e+00 4.525329e-03
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## [3852,] 0.000000e+00 0.000000e+00 0.000000e+00 6.262635e-03 0.000000e+00
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## [3860,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [3864,] 7.935922e-03 2.549032e-02 3.439611e-02 4.701125e-02 8.028816e-03
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## [3867,] 9.224683e-03 0.000000e+00 5.465796e-03 7.892046e-03 9.350216e-03
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## [3871,] 0.000000e+00 1.354349e-03 0.000000e+00 0.000000e+00 0.000000e+00
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## [4046,] 3.139216e-03 1.025696e-03 0.000000e+00 0.000000e+00 3.153794e-03
## [4047,] 6.645656e-04 0.000000e+00 0.000000e+00 0.000000e+00 6.652392e-04
## [4048,] 1.801968e-03 5.058638e-03 1.278723e-02 5.597287e-03 1.806799e-03
## [4049,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [4050,] 6.460319e-03 0.000000e+00 6.732578e-04 9.753211e-03 6.521884e-03
## [4051,] 6.161161e-03 0.000000e+00 0.000000e+00 9.170635e-03 6.217159e-03
## [4052,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4054,] 3.796342e-03 0.000000e+00 0.000000e+00 0.000000e+00 3.817637e-03
## [4055,] 8.976663e-04 9.156917e-03 8.310962e-03 4.955792e-03 8.988828e-04
## [4056,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [4057,] 1.308963e-02 9.716693e-03 1.739286e-02 1.840465e-02 1.334265e-02
## [4058,] 0.000000e+00 0.000000e+00 1.420289e-03 1.822201e-03 0.000000e+00
## [4059,] 0.000000e+00 3.484483e-03 0.000000e+00 1.192216e-03 0.000000e+00
## [4060,] 0.000000e+00 4.238808e-03 0.000000e+00 7.522054e-03 0.000000e+00
## [4061,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [4062,] 1.628973e-03 6.386315e-04 0.000000e+00 2.479221e-03 1.632927e-03
## [4063,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [4064,] 7.454156e-03 4.085871e-03 6.738535e-03 8.483860e-03 7.536113e-03
## [4065,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4067,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4069,] 0.000000e+00 0.000000e+00 0.000000e+00 5.815294e-05 0.000000e+00
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## [4071,] 0.000000e+00 3.906524e-03 0.000000e+00 0.000000e+00 0.000000e+00
## [4072,] 5.102853e-03 1.025519e-02 1.175917e-02 0.000000e+00 5.141281e-03
## [4073,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4078,] 2.788146e-03 3.223048e-03 4.272949e-03 2.386254e-03 2.799656e-03
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## [4101,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4241,] 5.895886e-03 6.244379e-03 6.959040e-03 1.373786e-02 5.947169e-03
## [4242,] 7.961019e-03 0.000000e+00 0.000000e+00 0.000000e+00 8.054502e-03
## [4243,] 3.577082e-03 1.721535e-03 1.375096e-03 7.535501e-03 3.595994e-03
## [4244,] 1.101327e-03 5.150895e-03 1.383192e-02 1.718354e-02 1.103149e-03
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## [4246,] 1.924349e-03 1.074342e-03 5.631339e-03 1.412823e-02 1.929853e-03
## [4247,] 7.784918e-03 1.997599e-03 3.477586e-03 8.455040e-03 7.874310e-03
## [4248,] 2.997612e-03 1.206482e-03 0.000000e+00 0.000000e+00 3.010909e-03
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## [4250,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4252,] 0.000000e+00 0.000000e+00 0.000000e+00 3.486587e-03 0.000000e+00
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## [4255,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4257,] 0.000000e+00 4.591035e-04 1.108164e-02 3.922276e-03 0.000000e+00
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## [4261,] 1.092179e-02 1.572912e-02 1.410951e-02 1.796685e-02 1.109783e-02
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## [4450,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4626,] 2.371714e-04 8.278161e-03 7.023202e-03 0.000000e+00 2.372633e-04
## [4627,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4630,] 2.342955e-03 9.180741e-03 3.807056e-04 6.920528e-03 2.351096e-03
## [4631,] 1.962941e-03 6.205927e-03 7.820099e-03 3.589673e-03 1.968667e-03
## [4632,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4634,] 5.132627e-03 2.005413e-03 9.290353e-03 1.041759e-03 5.171504e-03
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## [4638,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4640,] 3.890981e-04 0.000000e+00 2.565620e-03 1.495064e-03 3.893355e-04
## [4641,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4647,] 2.572488e-03 6.974772e-03 1.174125e-02 2.217695e-03 2.582293e-03
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## [4649,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4651,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4656,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4666,] 8.528354e-04 2.701853e-03 2.961593e-04 1.184899e-02 8.539351e-04
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## [4668,] 1.380669e-02 1.684479e-02 1.408005e-02 9.664490e-03 1.408826e-02
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## [4670,] 7.479079e-04 2.934199e-03 4.774094e-03 3.074972e-04 7.487573e-04
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## [4678,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4702,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4706,] 0.000000e+00 7.716792e-03 0.000000e+00 0.000000e+00 0.000000e+00
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## [4819,] 1.231205e-03 4.573656e-03 9.944670e-03 2.557953e-02 1.233476e-03
## [4820,] 1.637145e-04 5.729353e-03 4.539187e-03 0.000000e+00 1.637604e-04
## [4821,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [4822,] 1.080912e-02 6.818147e-03 8.326924e-03 1.244751e-02 1.098154e-02
## [4823,] 0.000000e+00 0.000000e+00 7.190653e-03 0.000000e+00 0.000000e+00
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## [4825,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4827,] 2.152814e-03 0.000000e+00 1.650833e-03 3.471090e-03 2.159693e-03
## [4828,] 0.000000e+00 9.092092e-04 0.000000e+00 0.000000e+00 0.000000e+00
## [4829,] 6.930117e-03 8.782452e-03 1.125641e-02 6.272246e-03 7.000957e-03
## [4830,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4832,] 0.000000e+00 0.000000e+00 0.000000e+00 6.128089e-03 0.000000e+00
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## [4836,] 0.000000e+00 0.000000e+00 1.521420e-03 6.411500e-03 0.000000e+00
## [4837,] 3.661847e-04 0.000000e+00 0.000000e+00 0.000000e+00 3.663958e-04
## [4838,] 4.641555e-03 7.502409e-03 1.890645e-02 1.862474e-02 4.673359e-03
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## [4851,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4853,] 1.834115e-02 2.328118e-02 2.263051e-02 2.522309e-02 1.883888e-02
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## [4855,] 4.264566e-03 2.684831e-03 0.000000e+00 0.000000e+00 4.291422e-03
## [4856,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4861,] 7.900582e-03 1.401197e-02 1.325323e-02 2.583965e-02 7.992650e-03
## [4862,] 3.605591e-03 2.318513e-03 9.237142e-03 7.800105e-04 3.624805e-03
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## [4868,] 4.811390e-03 3.781200e-03 4.097301e-03 3.376688e-03 4.845559e-03
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## [4877,] 1.140337e-03 4.374553e-03 1.058713e-02 1.064174e-02 1.142288e-03
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## [4884,] 6.124894e-03 1.189436e-02 8.163796e-03 1.420604e-02 6.180235e-03
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## [4902,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [4915,] 3.935651e-03 1.580309e-03 7.346926e-03 6.042979e-03 3.958533e-03
## [4916,] 3.336523e-03 1.507682e-02 9.286364e-03 0.000000e+00 3.352984e-03
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## [4952,] 0.000000e+00 0.000000e+00 3.202873e-05 0.000000e+00 0.000000e+00
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## [4990,] 3.037229e-03 0.000000e+00 0.000000e+00 0.000000e+00 3.050879e-03
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## [5013,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5015,] 3.618570e-03 1.709841e-02 1.435403e-02 1.763685e-02 3.637922e-03
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## [5023,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5400,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5408,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5410,] 1.038607e-02 1.742037e-02 1.040564e-02 1.084835e-02 1.054524e-02
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## [5412,] 2.216220e-03 1.141055e-02 1.672874e-02 2.089399e-02 2.223509e-03
## [5413,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5419,] 4.160290e-03 2.359120e-03 1.129789e-03 8.154120e-03 4.185852e-03
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## [5592,] 3.952234e-03 3.283015e-03 3.540391e-03 0.000000e+00 3.975309e-03
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## [5786,] 7.610970e-03 8.033147e-03 2.610362e-03 5.145468e-03 7.696411e-03
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## [5979,] 0.000000e+00 5.475229e-03 1.117194e-02 5.905043e-03 0.000000e+00
## [5980,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5982,] 0.000000e+00 7.899042e-03 0.000000e+00 0.000000e+00 0.000000e+00
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## [5985,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [5988,] 1.211579e-02 8.315733e-03 7.463699e-03 2.036930e-03 1.233249e-02
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## [5994,] 2.571899e-03 9.875267e-04 1.324829e-02 8.803152e-03 2.581700e-03
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## [6002,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [6173,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [6182,] 0.000000e+00 0.000000e+00 0.000000e+00 1.695359e-02 0.000000e+00
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## [6201,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [6205,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [6751,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [6752,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [6770,] 7.423009e-03 4.666575e-03 1.098446e-03 0.000000e+00 7.504282e-03
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## [7912,] 1.175173e-02 2.418797e-02 9.812877e-03 2.164098e-03 1.195558e-02
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## [8100,] 5.789546e-03 3.110842e-03 6.958709e-03 9.477487e-03 5.838997e-03
## [8101,] 7.807748e-04 6.412903e-03 7.492722e-03 4.079915e-03 7.816991e-04
## [8102,] 0.000000e+00 1.213279e-03 0.000000e+00 0.000000e+00 0.000000e+00
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## [8105,] 6.086934e-03 3.994971e-03 1.343089e-02 0.000000e+00 6.141592e-03
## [8106,] 3.471170e-03 2.289611e-03 8.716714e-03 2.344603e-04 3.488982e-03
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## [8110,] 0.000000e+00 8.020573e-04 8.077346e-03 1.374730e-02 0.000000e+00
## [8111,] 4.105684e-03 5.258275e-03 1.281856e-03 0.000000e+00 4.130581e-03
## [8112,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [8121,] 5.831832e-03 6.996634e-03 1.042533e-02 6.336633e-03 5.882008e-03
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## [8294,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [8295,] 1.290036e-02 1.251745e-02 1.385148e-02 1.559864e-02 1.314609e-02
## [8296,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [8298,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [8300,] 0.000000e+00 0.000000e+00 0.000000e+00 3.305702e-03 0.000000e+00
## [8301,] 7.119881e-03 1.080957e-02 9.932394e-03 5.952704e-03 7.194652e-03
## [8302,] 3.917685e-04 1.028669e-03 0.000000e+00 0.000000e+00 3.920090e-04
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## [8305,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [8310,] 8.050671e-04 6.787234e-03 9.457375e-03 8.515193e-03 8.060489e-04
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## [8313,] 4.483167e-03 7.086784e-03 1.841741e-02 2.076442e-02 4.512842e-03
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## [8411,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [8495,] 6.126682e-04 3.417969e-03 8.208920e-03 1.005036e-02 6.132426e-04
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## [9073,] 3.148698e-03 1.260243e-03 1.144400e-02 1.423966e-02 3.163364e-03
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## [9089,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [9111,] 3.497562e-03 6.451315e-03 9.506158e-03 1.461025e-02 3.515645e-03
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## [9663,] 5.167455e-03 1.433987e-02 2.110635e-02 1.958369e-02 5.206861e-03
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## [10039,] 0.000000e+00 0.000000e+00 8.128475e-03 0.000000e+00 0.000000e+00
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## [10041,] 7.853419e-03 1.704927e-02 4.180887e-03 8.553488e-03 7.944391e-03
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## [10239,] 8.552372e-03 1.092824e-02 3.987050e-03 0.000000e+00 8.660263e-03
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## [10252,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [10816,] 8.494450e-03 7.315105e-03 1.010748e-03 7.516608e-05 8.600885e-03
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## [11007,] 0.000000e+00 0.000000e+00 8.204271e-04 9.229732e-04 0.000000e+00
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## [11009,] 6.942273e-03 1.543599e-03 0.000000e+00 0.000000e+00 7.013361e-03
## [11010,] 0.000000e+00 0.000000e+00 1.632251e-03 0.000000e+00 0.000000e+00
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## [11012,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [11394,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [11400,] 5.470174e-03 1.470826e-03 0.000000e+00 4.627551e-03 5.514325e-03
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## [12361,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
## [12362,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [12365,] 2.800520e-04 1.666922e-03 0.000000e+00 0.000000e+00 2.801782e-04
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## [12369,] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
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## [12380,] 0.000000e+00 0.000000e+00 3.097391e-04 0.000000e+00 0.000000e+00
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## [12394,] 7.663957e-03 7.163132e-03 0.000000e+00 0.000000e+00 7.750592e-03
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## [12396,] 1.752812e-02 1.461127e-02 1.555317e-02 2.386716e-02 1.798255e-02
## [12397,] 9.407496e-04 6.081553e-03 5.775301e-03 9.179577e-05 9.420838e-04
## [12398,] 5.141355e-03 1.304819e-02 1.295806e-02 2.136550e-02 5.180364e-03
## [12399,] 0.000000e+00 3.942772e-04 0.000000e+00 0.000000e+00 0.000000e+00
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## [12401,] 0.000000e+00 0.000000e+00 2.494214e-03 1.327121e-03 0.000000e+00
## [12402,] 5.265357e-03 1.162083e-02 2.013187e-02 2.966960e-02 5.306268e-03
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## [12404,] 1.452186e-02 1.659761e-02 2.255374e-02 1.705478e-02 1.483343e-02
## [12405,] 0.000000e+00 3.342299e-03 1.579289e-02 1.691215e-02 0.000000e+00
## [12406,] 0.000000e+00 0.000000e+00 1.312215e-03 1.352076e-02 0.000000e+00
## [12407,] 3.793913e-04 6.196594e-03 1.155492e-02 1.539529e-02 3.796173e-04
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## [12411,] 1.048672e-02 2.483898e-03 3.006936e-03 0.000000e+00 1.064899e-02
## [12412,] 0.000000e+00 3.990905e-04 3.653857e-04 0.000000e+00 0.000000e+00
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## [12421,] 6.560243e-03 1.312952e-02 1.076867e-02 3.049245e-03 6.623726e-03
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## [12429,] 1.467990e-02 1.008946e-02 2.877756e-02 4.057589e-02 1.499830e-02
## [12430,] 7.408387e-03 6.615883e-03 8.215124e-03 1.133972e-02 7.489340e-03
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## [12445,] 1.178076e-02 3.720826e-03 8.910084e-03 9.010113e-03 1.198562e-02
## [12446,] 1.759595e-03 5.282323e-03 1.717231e-02 1.419148e-02 1.764203e-03
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## [12462,] 9.038502e-04 4.261352e-03 9.112496e-03 2.076717e-03 9.050832e-04
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## [12469,] 5.417523e-04 5.805491e-04 0.000000e+00 0.000000e+00 5.422039e-04
## [12470,] 2.904280e-03 1.256878e-02 1.172265e-02 1.529583e-02 2.916765e-03
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## [12476,] 9.881510e-04 0.000000e+00 0.000000e+00 9.196938e-04 9.896212e-04
## [12477,] 2.808097e-03 8.141468e-03 6.219678e-03 8.050941e-03 2.819772e-03
## [12478,] 0.000000e+00 1.017666e-03 0.000000e+00 1.185058e-03 0.000000e+00
## [12479,] 4.564485e-03 2.273364e-03 5.566103e-03 0.000000e+00 4.595244e-03
## [12480,] 2.350286e-03 4.599331e-04 1.563096e-03 1.240038e-02 2.358478e-03
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## [12483,] 2.031670e-03 6.539674e-03 8.902877e-03 1.814464e-02 2.037801e-03
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## [12487,] 3.393717e-03 0.000000e+00 3.908967e-03 8.148854e-03 3.410745e-03
## [12488,] 4.722116e-03 3.724144e-03 1.003231e-02 1.011865e-02 4.755032e-03
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## [12490,] 9.181420e-03 5.039042e-03 6.939270e-03 9.157620e-03 9.305778e-03
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##
##          V2_CORR          V3_CORR          V4_CORR
## [1,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2,] 0.000000e+00 0.000000e+00 0.000000e+00

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##      [3,] 1.002925e-02 1.516669e-02 1.081312e-02
##      [4,] 0.000000e+00 0.000000e+00 9.104328e-03
##      [5,] 3.572865e-03 1.433418e-03 0.000000e+00
##      [6,] 0.000000e+00 0.000000e+00 0.000000e+00
##      [7,] 1.004635e-02 2.151911e-02 7.584798e-03
##      [8,] 5.554208e-03 0.000000e+00 0.000000e+00
##      [9,] 1.124242e-02 2.989255e-03 0.000000e+00
##     [10,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [11,] 3.371242e-03 0.000000e+00 0.000000e+00
##     [12,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [13,] 5.000137e-04 2.021787e-03 0.000000e+00
##     [14,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [15,] 0.000000e+00 5.777018e-03 3.762356e-03
##     [16,] 3.123572e-03 0.000000e+00 0.000000e+00
##     [17,] 1.414101e-03 4.208934e-04 2.062414e-03
##     [18,] 2.330515e-03 1.403062e-02 1.079495e-02
##     [19,] 1.795871e-02 1.884922e-02 1.419679e-02
##     [20,] 0.000000e+00 5.974766e-04 0.000000e+00
##     [21,] 1.019303e-03 1.185896e-02 1.575568e-02
##     [22,] 1.283496e-02 8.718460e-03 0.000000e+00
##     [23,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [24,] 7.900198e-03 1.057125e-02 8.486217e-03
##     [25,] 0.000000e+00 0.000000e+00 7.026520e-03
##     [26,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [27,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [28,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [29,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [30,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [31,] 0.000000e+00 2.601611e-03 0.000000e+00
##     [32,] 1.707767e-02 1.302560e-02 9.260279e-03
##     [33,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [34,] 0.000000e+00 5.467567e-03 0.000000e+00
##     [35,] 6.736336e-03 6.279180e-03 7.492331e-03
##     [36,] 1.034839e-02 2.090051e-03 8.395796e-03
##     [37,] 0.000000e+00 0.000000e+00 0.000000e+00
##     [38,] 2.376590e-03 1.285194e-03 1.004875e-02
##     [39,] 2.150497e-03 7.089676e-05 5.612930e-03
##     [40,] 1.412572e-03 3.357267e-04 0.000000e+00
##     [41,] 0.000000e+00 0.000000e+00 4.009523e-03
##     [42,] 0.000000e+00 0.000000e+00 0.000000e+00
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##     [44,] 1.394925e-03 0.000000e+00 0.000000e+00
##     [45,] 4.600051e-03 1.515458e-02 9.717359e-03
##     [46,] 2.157347e-03 3.192424e-03 0.000000e+00
##     [47,] 2.104168e-03 0.000000e+00 0.000000e+00
##     [48,] 5.799912e-03 0.000000e+00 0.000000e+00
##     [49,] 3.681104e-03 1.501783e-03 9.555332e-04
##     [50,] 1.094579e-02 3.909496e-03 1.988563e-02
##     [51,] 7.828879e-03 1.841091e-02 2.492448e-02
##     [52,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [54,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [63,] 2.586010e-03 1.416932e-03 0.000000e+00
## [64,] 2.945012e-03 3.301700e-03 0.000000e+00
## [65,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [67,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [69,] 6.407771e-04 3.234514e-04 9.597728e-04
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## [1290,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [1408,] 1.572685e-02 2.217862e-02 1.161530e-02
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## [1542,] 0.000000e+00 0.000000e+00 3.872427e-03
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## [1544,] 3.028885e-03 3.383727e-03 1.111802e-02
## [1545,] 4.716537e-03 0.000000e+00 2.823688e-03
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## [1833,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [1850,] 1.147017e-02 1.100859e-02 7.220584e-03
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## [1852,] 1.690829e-03 1.720346e-03 1.039897e-03
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## [1902,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [1913,] 1.400533e-02 5.016351e-03 2.447261e-03
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## [2019,] 2.286476e-02 2.259868e-02 2.425397e-02
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## [2113,] 0.000000e+00 7.465176e-03 4.816832e-03
## [2114,] 1.993728e-03 2.438647e-03 1.958168e-02
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## [2117,] 4.374359e-03 2.222212e-05 0.000000e+00
## [2118,] 3.469668e-03 1.097242e-02 1.706283e-02
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## [2121,] 7.939480e-03 9.975965e-03 2.133613e-03
## [2122,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2129,] 0.000000e+00 8.579009e-05 3.710448e-03
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## [2152,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2214,] 9.512147e-03 9.591875e-03 5.543429e-03
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## [2402,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2406,] 0.000000e+00 2.024030e-04 3.285822e-03
## [2407,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2409,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2411,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2414,] 0.000000e+00 3.367514e-03 0.000000e+00
## [2415,] 1.792548e-03 0.000000e+00 0.000000e+00
## [2416,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2417,] 0.000000e+00 3.095796e-03 3.399920e-03
## [2418,] 0.000000e+00 6.107439e-04 5.685808e-03
## [2419,] 1.028693e-02 1.501656e-02 1.191489e-02
## [2420,] 9.377496e-03 9.452876e-03 4.372364e-03
## [2421,] 4.207689e-03 3.055161e-03 6.219887e-03
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## [2426,] 2.570872e-03 1.577919e-02 1.167035e-02
## [2427,] 5.778926e-03 3.319457e-03 8.816638e-03
## [2428,] 6.554655e-03 1.388932e-02 1.217717e-02
## [2429,] 4.713226e-03 3.879365e-03 0.000000e+00
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## [2433,] 6.030211e-03 5.385930e-03 2.621049e-02
## [2434,] 0.000000e+00 0.000000e+00 1.178982e-02
## [2435,] 4.723497e-03 2.683050e-03 3.609095e-03
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## [2437,] 0.000000e+00 8.830505e-04 1.244930e-03
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## [2440,] 1.200657e-02 1.172696e-02 1.434517e-02
## [2441,] 2.820504e-03 2.845005e-03 3.890862e-03
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## [2443,] 9.686371e-03 3.263847e-03 5.704130e-04
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## [2452,] 3.537237e-03 0.000000e+00 5.368049e-05
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## [2462,] 2.102364e-03 2.137174e-03 3.045859e-03
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## [2575,] 0.000000e+00 3.318700e-03 0.000000e+00
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## [2584,] 0.000000e+00 1.125284e-03 0.000000e+00
## [2585,] 1.150753e-02 9.167063e-03 1.592701e-02
## [2586,] 1.103050e-02 8.020784e-03 4.824551e-04
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## [2589,] 0.000000e+00 2.414148e-03 0.000000e+00
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## [2646,] 3.065332e-03 0.000000e+00 0.000000e+00
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## [2663,] 1.577708e-03 5.993779e-03 4.482824e-03
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## [2686,] 1.732847e-04 0.000000e+00 1.328530e-03
## [2687,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2688,] 1.829937e-02 2.477044e-02 2.367668e-02
## [2689,] 5.865369e-03 0.000000e+00 0.000000e+00
## [2690,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2691,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2692,] 9.705265e-03 0.000000e+00 2.087101e-03
## [2693,] 3.033679e-03 0.000000e+00 0.000000e+00
## [2694,] 1.085542e-02 1.368059e-02 1.018826e-02
## [2695,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2697,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2698,] 6.505808e-03 2.821551e-04 6.524028e-03
## [2699,] 2.335903e-03 0.000000e+00 9.424935e-03
## [2700,] 8.577459e-03 2.634856e-02 3.041010e-02
## [2701,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2702,] 0.000000e+00 3.032623e-03 1.240566e-02
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## [2704,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2705,] 1.287048e-02 6.687534e-03 8.569798e-04
## [2706,] 0.000000e+00 3.417093e-03 0.000000e+00
## [2707,] 1.445344e-02 2.192468e-02 2.969480e-02
## [2708,] 2.309084e-03 0.000000e+00 0.000000e+00
## [2709,] 9.346719e-03 1.656240e-02 1.506069e-02
## [2710,] 0.000000e+00 1.661118e-03 1.149603e-03
## [2711,] 1.237384e-04 8.785091e-04 0.000000e+00
## [2712,] 8.668361e-04 0.000000e+00 0.000000e+00
## [2713,] 1.925173e-02 3.394577e-02 3.847366e-02
## [2714,] 0.000000e+00 1.375939e-03 1.546471e-03
## [2715,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2716,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2717,] 3.441819e-03 5.758408e-03 3.853536e-03
## [2718,] 5.917856e-03 2.050242e-03 3.467709e-03
## [2719,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2720,] 1.852391e-04 3.430492e-03 1.267833e-02
## [2721,] 6.254591e-03 1.075836e-02 2.666082e-02
## [2722,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2725,] 1.234682e-02 5.016704e-04 0.000000e+00
## [2726,] 0.000000e+00 0.000000e+00 6.232395e-04
## [2727,] 2.013679e-03 4.394345e-03 0.000000e+00
## [2728,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2729,] 1.665819e-02 1.013139e-02 5.450000e-03
## [2730,] 9.716252e-03 1.329247e-02 3.215992e-03
## [2731,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2742,] 1.071628e-02 3.349803e-02 1.877282e-02
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## [2746,] 1.937337e-02 5.710411e-03 0.000000e+00
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## [2863,] 0.000000e+00 0.000000e+00 0.000000e+00
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```



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## [2975,] 0.000000e+00 1.199813e-03 8.478376e-03
## [2976,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2978,] 1.471600e-02 7.954017e-03 1.687761e-02
## [2979,] 1.789977e-02 1.943682e-02 1.730570e-02
## [2980,] 3.919984e-03 0.000000e+00 0.000000e+00
## [2981,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2982,] 9.576910e-03 2.738331e-02 4.636864e-02
## [2983,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2984,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [2987,] 1.056335e-03 0.000000e+00 0.000000e+00
## [2988,] 0.000000e+00 3.418786e-04 5.026126e-03
## [2989,] 1.346922e-03 4.757167e-03 1.204452e-02
## [2990,] 0.000000e+00 0.000000e+00 1.632778e-03
## [2991,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2992,] 0.000000e+00 0.000000e+00 2.760035e-04
## [2993,] 1.294039e-02 6.850029e-04 0.000000e+00
## [2994,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2995,] 3.235748e-03 8.163516e-03 7.998017e-03
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## [2998,] 0.000000e+00 0.000000e+00 0.000000e+00
## [2999,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3002,] 9.566152e-04 5.797152e-03 4.128372e-03
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## [3006,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3008,] 2.364659e-03 0.000000e+00 0.000000e+00
## [3009,] 7.372142e-04 2.673088e-03 2.642815e-03
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## [3011,] 0.000000e+00 1.096346e-03 1.817544e-02
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## [3013,] 8.989442e-03 1.784331e-02 1.897078e-02
## [3014,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3016,] 8.882966e-03 9.185943e-03 1.150262e-02
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## [3038,] 7.513389e-03 1.688257e-02 7.745513e-03
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## [3069,] 8.353123e-03 6.988851e-03 6.225602e-04
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## [3104,] 2.997068e-03 0.000000e+00 0.000000e+00
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## [3110,] 2.382347e-04 1.301670e-03 1.185367e-02
## [3111,] 5.008320e-03 6.975284e-03 1.705809e-02
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## [3152,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3210,] 2.722464e-03 6.093478e-03 1.224316e-02
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## [3214,] 1.284160e-02 2.151402e-02 2.929139e-02
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## [3408,] 6.182896e-03 5.418503e-03 6.128154e-03
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## [3551,] 2.193028e-05 0.000000e+00 2.001326e-03
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## [3568,] 1.097514e-02 2.086603e-02 1.228654e-02
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## [3602,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3836,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3838,] 5.838666e-03 7.473976e-03 4.697118e-03
## [3839,] 4.720636e-03 5.405077e-03 0.000000e+00
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## [3841,] 5.838115e-03 8.663942e-03 5.625835e-03
## [3842,] 0.000000e+00 0.000000e+00 0.000000e+00
## [3843,] 1.219855e-03 3.458034e-04 6.074913e-03
## [3844,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3846,] 0.000000e+00 0.000000e+00 0.000000e+00
## [3847,] 1.067231e-02 6.253899e-03 5.644075e-03
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## [3849,] 8.067813e-03 2.295049e-03 0.000000e+00
## [3850,] 9.352460e-03 6.192402e-03 6.664824e-03
## [3851,] 7.072471e-03 3.319249e-03 0.000000e+00
## [3852,] 0.000000e+00 0.000000e+00 6.262635e-03
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## [3855,] 0.000000e+00 0.000000e+00 6.357138e-04
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## [3858,] 2.701232e-04 0.000000e+00 0.000000e+00
## [3859,] 5.773114e-03 1.964771e-02 1.960730e-02
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## [3861,] 0.000000e+00 0.000000e+00 0.000000e+00
## [3862,] 0.000000e+00 0.000000e+00 0.000000e+00
## [3863,] 7.874488e-03 3.845918e-03 1.478204e-02
## [3864,] 2.612985e-02 3.497465e-02 4.701125e-02
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## [3867,] 0.000000e+00 5.480496e-03 7.892046e-03
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## [3877,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [3901,] 1.320372e-03 6.461393e-03 1.590617e-02
## [3902,] 1.261118e-02 3.333097e-03 2.470245e-03
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## [3914,] 1.275839e-03 0.000000e+00 0.000000e+00
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## [3919,] 0.000000e+00 0.000000e+00 0.000000e+00
## [3920,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4134,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4693,] 2.022504e-03 0.000000e+00 0.000000e+00
## [4694,] 0.000000e+00 6.362760e-03 4.794301e-03
## [4695,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4696,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4698,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4699,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4700,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4701,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4702,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4704,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4705,] 4.137340e-03 0.000000e+00 0.000000e+00
## [4706,] 7.775350e-03 0.000000e+00 0.000000e+00
## [4707,] 1.696034e-02 1.259313e-02 1.129869e-02
## [4708,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4709,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4711,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4712,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4713,] 9.707738e-03 6.347525e-04 4.018877e-03
## [4714,] 0.000000e+00 1.098412e-03 7.509130e-03
## [4715,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4716,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4718,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4719,] 9.971221e-03 7.384078e-03 1.019494e-02
## [4720,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4721,] 8.852686e-03 4.758633e-03 5.091590e-03
## [4722,] 0.000000e+00 2.254634e-03 0.000000e+00
## [4723,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4725,] 4.857576e-03 1.100978e-02 0.000000e+00
## [4726,] 3.864708e-04 0.000000e+00 0.000000e+00
## [4727,] 8.773438e-03 1.186503e-02 3.404010e-03
## [4728,] 2.073218e-02 1.977184e-02 1.865549e-02
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## [4730,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4732,] 1.021434e-04 2.518978e-03 1.934476e-02
## [4733,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4734,] 0.000000e+00 6.352929e-03 3.806296e-03
## [4735,] 0.000000e+00 7.174716e-04 0.000000e+00
## [4736,] 0.000000e+00 2.240011e-03 5.099322e-03
## [4737,] 4.997310e-03 7.427939e-03 8.368733e-03
## [4738,] 0.000000e+00 0.000000e+00 1.261865e-03
## [4739,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4740,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4742,] 0.000000e+00 0.000000e+00 2.312146e-03
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## [4744,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4747,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4749,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4750,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4751,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4752,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4756,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4758,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4759,] 4.298082e-03 0.000000e+00 0.000000e+00
## [4760,] 1.091039e-02 1.882070e-02 2.531125e-02
## [4761,] 5.761066e-03 0.000000e+00 0.000000e+00
## [4762,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4764,] 2.443290e-02 1.969840e-02 1.955957e-02
## [4765,] 2.251743e-04 0.000000e+00 0.000000e+00
## [4766,] 2.229602e-02 1.478502e-02 1.243845e-02
## [4767,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4770,] 1.490350e-02 1.886388e-02 1.585924e-02
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## [4777,] 0.000000e+00 5.388894e-04 0.000000e+00
## [4778,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4780,] 0.000000e+00 8.941907e-03 8.393903e-03
## [4781,] 1.849704e-02 1.785334e-02 1.504657e-02
## [4782,] 0.000000e+00 0.000000e+00 4.962213e-03
## [4783,] 0.000000e+00 1.754167e-03 7.731208e-03
## [4784,] 0.000000e+00 9.152337e-04 5.334712e-03
## [4785,] 1.454881e-02 1.602725e-02 1.426993e-02
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## [4797,] 0.000000e+00 1.330025e-04 1.051861e-03
## [4798,] 6.342917e-03 1.216255e-02 1.795732e-04
## [4799,] 1.059472e-02 1.793229e-02 1.340322e-02
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## [4802,] 1.183082e-03 1.197121e-02 5.424979e-03
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## [4806,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4809,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4812,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4813,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4815,] 1.033088e-02 5.974052e-03 1.305459e-02
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## [4823,] 0.000000e+00 7.216033e-03 0.000000e+00
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## [4827,] 0.000000e+00 1.652196e-03 3.471090e-03
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## [4832,] 0.000000e+00 0.000000e+00 6.128089e-03
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## [4836,] 0.000000e+00 1.522577e-03 6.411500e-03
## [4837,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4841,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4857,] 1.120122e-02 7.116577e-03 0.000000e+00
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## [4859,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4860,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4861,] 1.420496e-02 1.333930e-02 2.583965e-02
## [4862,] 2.323862e-03 9.278992e-03 7.800105e-04
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## [4865,] 0.000000e+00 0.000000e+00 0.000000e+00
## [4866,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4868,] 3.795333e-03 4.105584e-03 3.376688e-03
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## [4877,] 4.393436e-03 1.064208e-02 1.064174e-02
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## [4880,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4882,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4889,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4913,] 0.000000e+00 3.227730e-03 0.000000e+00
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## [4915,] 1.582814e-03 7.373432e-03 6.042979e-03
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## [4949,] 4.399038e-03 2.958173e-03 7.142806e-03
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## [4952,] 0.000000e+00 3.202984e-05 0.000000e+00
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## [4962,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4988,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4990,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4992,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [4994,] 2.827220e-04 1.592816e-03 1.679670e-03
## [4995,] 3.337446e-04 4.468539e-04 1.226856e-02
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## [4997,] 3.170019e-03 3.649175e-03 7.540841e-03
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## [5270,] 0.000000e+00 4.467236e-03 6.696973e-03
## [5271,] 0.000000e+00 0.000000e+00 7.219557e-03
## [5272,] 0.000000e+00 0.000000e+00 0.000000e+00
## [5273,] 4.798094e-03 1.114877e-02 1.876265e-02
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## [5275,] 2.868785e-02 2.502081e-02 2.369333e-02
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## [5281,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [5287,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [5289,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [5294,] 1.025358e-02 1.936711e-02 1.799691e-02
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## [5297,] 4.551885e-05 0.000000e+00 2.332776e-03
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## [5299,] 2.706447e-04 1.050187e-03 1.350672e-03
## [5300,] 0.000000e+00 3.942501e-03 1.167819e-03
## [5301,] 7.207270e-03 1.906407e-02 1.249644e-02
## [5302,] 1.056786e-02 1.392455e-02 1.938593e-02
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## [5310,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [5317,] 6.073855e-03 0.000000e+00 1.579242e-03
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## [6702,] 0.000000e+00 1.625950e-04 0.000000e+00
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## [6706,] 7.336993e-03 1.467880e-03 0.000000e+00
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## [6734,] 0.000000e+00 4.013536e-05 1.105153e-03
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## [6828,] 1.007461e-02 9.387951e-03 3.055267e-03
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## [12152,] 0.000000e+00 0.000000e+00 0.000000e+00
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## [12439,] 1.787745e-02 3.065929e-02 4.547901e-02
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## [12451,] 0.000000e+00 0.000000e+00 0.000000e+00
## [12452,] 7.021539e-03 1.161091e-02 1.008942e-02
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## [12499,] 0.000000e+00 0.000000e+00 0.000000e+00
## [ reached getOption("max.print") -- omitted 87501 rows ]
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