Here is your task

Your task is to implement a novel data structure – your project lead is calling it a power of two max heap. The rest of your team is doing their best to come up with a better name. The requirements of the data structure are as follows:

- The heap must satisfy the heap property.
- Every parent node in the heap must have 2^x children.
- The value of x must be a parameter of the heap's constructor.
- The heap must implement an insert method.
- The heap must implement a pop max method.
- The heap must be implemented in Java.
- The heap must be performant.
- You must use a more descriptive variable name than x in your implementation.

Think carefully about how you implement each method, and manage the underlying data. Performance is critical, so keep cycles and memory usage to a minimum. Be sure to test your heap with very small and very large values of x. As always, keep a weather eye out for sneaky edge cases.

```java
import java.util.Arrays;
import java.util.NoSuchElementException;

public class PowerHeap {
    private double x;
    private int size;
    private int[] heapArray;

    // Constructor
    public PowerHeap(double x, int capacity) {
        this.size = 0;
        heapArray = new int[capacity + 1];
        this.x = x;
        Arrays.fill(heapArray, -1);
    }

    private int parent(int i) {
        return (int) ((i - 1) / Math.pow(a:2, x));
    }

    public boolean isFull() {
        return size == heapArray.length;
    }

    public void insert(int value) {
        if (isFull()) {
            throw new NoSuchElementException(s:"Heap is full, no space to insert new element.");
        } else {
            heapArray[size++] = value;
            heapifyUp(size - 1);
        }
    }

    private void heapifyUp(int i) {
        int tmp = heapArray[i];
        while (i > 0 && tmp > heapArray[parent(i)]) {
            heapArray[i] = heapArray[parent(i)];
            i = parent(i);
        }
        heapArray[i] = tmp;
    }
}
```

```java
    public int popMax() {
        int maxItem = heapArray[0];
        heapArray[0] = heapArray[size - 1];
        heapArray[size - 1] = -1;
        size--;

        int i = 0;
        while (i < size - 1) {
            heapifyUp(i);
            i++;
        }

        return maxItem;
    }


    public void print() {
        for (int i = 0; i < size; i++) {
            System.out.print(heapArray[i]);
            System.out.print(c:',');
        }
        System.out.println();
    }

    Run | Debug
    public static void main(String[] args) {
        double x = 2; // Example value for x
        int capacity = 10; // Example capacity

        PowerHeap heap = new PowerHeap(x, capacity);
        heap.insert(value:5);
        heap.insert(value:10);
        heap.insert(value:3);

        heap.print();

        int maxItem = heap.popMax();
        System.out.println("Max item: " + maxItem);

        heap.print();
    }
}
```

```
roopaboddula@roopas-MacBook-Air Walmart-virtual-Internship %  /usr/bin/env /Library/Java/JavaVirtualMachines/jdk-21.jdk/Contents/Home/bin/java -agentlib:jdwp=transport=
dt_socket,server=n,suspend=y,address=localhost:63850 --enable-preview -XX:+ShowCodeDetailsInExceptionMessages -cp /Users/roopaboddula/Library/Application\ Support/Code/
User/workspaceStorage/b0e8d93ad6992b9c7500f80ea07f3a0e/redhat.java/jdt_ws/Walmart-virtual-Internship_998e1b4e/bin PowerHeap
10,5,3,
Max item: 10
3,5,
roopaboddula@roopas-MacBook-Air Walmart-virtual-Internship %  cd /Users/roopaboddula/Desktop/walmart/Walmart-virtual-Internship ; /usr/bin/env /Library/Java/JavaVirtual
Machines/jdk-21.jdk/Contents/Home/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:63873 --enable-preview -XX:+ShowCodeDetailsInExceptio
nMessages -cp /Users/roopaboddula/Library/Application\ Support/Code/User/workspaceStorage/b0e8d93ad6992b9c7500f80ea07f3a0e/redhat.java/jdt_ws/Walmart-virtual-Internship
_998e1b4e/bin PowerHeap
10,5,3,
Max item: 10
3,5,
roopaboddula@roopas-MacBook-Air Walmart-virtual-Internship %  cd /Users/roopaboddula/Desktop/walmart/Walmart-virtual-Internship ; /usr/bin/env /Library/Java/JavaVirtual
Machines/jdk-21.jdk/Contents/Home/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:63905 --enable-preview -XX:+ShowCodeDetailsInExceptio
nMessages -cp /Users/roopaboddula/Library/Application\ Support/Code/User/workspaceStorage/b0e8d93ad6992b9c7500f80ea07f3a0e/redhat.java/jdt_ws/Walmart-virtual-Internship
_998e1b4e/bin PowerHeap
Exception in thread "main" java.lang.Error: Unresolved compilation problem:

        at PowerHeap.main(PowerHeap.java:66)
roopaboddula@roopas-MacBook-Air Walmart-virtual-Internship % 
```