BIRZEIT UNIVERSITY

Spring Semester 2024/2025

ENCS4370- Computer Architecture

Project#1

Bin Packing Problem Solution Using MIPS Assembly

Deadline: April 12, 2025 at 23:59

1. Project Overview

In this project, you will implement a Bin Packing Solver using MIPS assembly language. The goal is to pack a list of items into the minimum number of bins using two heuristic approaches: First Fit (FF) and Best Fit (BF).

The **bin packing problem** is defined as follows: Given a collection of items I_1, I_2,… I_n with corresponding sizes S_1, S_2,… S_n. The size of each item is a floating-point number between 0 and 1. The goal is to pack these n items into the minimum number of bins of unit capacity, which means the capacity of each bin is one. In this project, we will solve the bin packing problem using the following two heuristics:

1. **First Fit (FF):** the bins are indexed sequentially as 1, 2, …All bins are initially empty. The items are considered for packing in the order I_1, I_2,… I_n. To pack an item I_i, find the least index j such that bin j has enough remaining capacity, i.e., it contains at most 1 - S_i, then add the item I_i to the items packed in the bin j.
2. **Best Fit (BF):** it is the same as **FF** except that when item I_i is packed, we pack it into the fullest bin that still has enough space to accommodate the item I_i.

Your MIPS assembly program should meet the following requirements:

1. The program reads a list of item sizes from an input text file.
2. The program prompts the user to enter the input file name or path.
3. The program validates the input file content and prints appropriate error messages, if the file does not exist or the input file content is invalid
4. The menu should remain in an infinite loop until the user decides to exit by entering ‘q’ or ‘Q’
5. The program prompts the user to choose the heuristic: FF or BF. This input is case insensitive.
6. The program solves the bin packing problem using the selected heuristic and prints the results to an output text file. The output includes the minimum number of required bins, and which items are packed in each bin.

Teamwork:

You can work on this project in teams of up to two students only. The team members can be from different sections.

Submission

You need to submit the complete MIPS assembly files

Grading Criteria

Note: if the program does not run, the code will be graded out of 70%

Criteria	**Grade**
Code structure, organization, and documentation	10
User interface (Menu)	10
Reading item sizes from the input text file	10
Writing the results to the output text file	10
User input validation and printing the appropriate messages	10
First fit heuristic implementation	25
Best fit heuristic implementation	25
Total	**100**

GOOD LUCK