所別：工業管理研究所碩士班 乙組 科目：作業研究

請注意，答題時請清楚地標明題號，沒標明題號或是題號標明不清者，以零分計算。共四大題。

1. (30 points) Buses arrive at a certain stop according to a Poisson process with rate λ. If you take the bus from that stop then it takes a time R, measured from the time you enter the bus, to arrive home. If you walk from the bus stop then it takes a time W to arrive home. Suppose that your policy when arriving at the bus stop is to wait up to a time s, and if a bus has not yet arrived by that time then you walk home.
   (a) Compute the expected time from when you arrive at the bus stop until you reach home. (10 points)
   (b) Show that if $W \le 1/\lambda + R$ then the expected time of part (a) is minimized by letting $s = 0$. (8 points)
   (c) Show that if $W > 1/\lambda + R$ then it is minimized by letting $s = \infty$. (7 points)
   (d) Show that when $W = 1/\lambda + R$ all values of s gives the same expected time. (5 points)

2. (20 points) Consider an *M/M/*1 queue with $\lambda < \mu$. You do not know the exact service discipline but the server is not allowed to idle unless the system is empty. Discuss the following questions.
   (a) Can you determine the long-run average waiting time in the system? If you can, what is it? (10 points)
   (b) What about the distribution of the stationary waiting time in the system? (10 points)

3. (25 points) JoShop needs to assign 4 jobs to 4 workers. The cost of performing a job is a function of the skills of the workers. Table 1 summarizes the cost of the assignments. Worker 1 cannot do job 3, and worker 3 cannot do job 4. Determine the optimal assignment using **the Hungarian method.**

Table 1

		Job			
		1	2	3	4
Worker	1	$50	$50	—	$20
	2	$70	$40	$20	$30
	3	$90	$30	$50	—
	4	$70	$20	$60	$70

4. (25 points) A hiker has a 5-ft^3 backpack and needs to decide on the most valuable items to take on the hiking trip. There are three items from which to choose. Their volumes are 2, 3, and 4 ft^3, and the hiker estimates their associated values on a scale from 0 to 100 as 30, 50, and 70 respectively. **Express the problem as a longest-route network and find the optimal solution.** (*Hint*: A node in the network may be defined as $[i, v]$, where i is the item number considered for packing, and v is the volume remaining immediately before the decision is made on i.)