

(一)

1. (12%) When we encode members of Z_2^m into Z_2^n ; such a code is called an (m, n) code. The first m components of a code word are the information digits, and the last r ($r = n - m$) components are the check digits. Please answer (1) which of the following are perfect codes, and (2) which are single-error correcting codes?
 (a) $(12, 7)$ (b) $(15, 11)$ (c) $(5, 3)$
2. (12%) How many nonnegative integer solutions are there to the inequality $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 < 10$.
3. (12%) Please solve the recurrence relation
$$\begin{cases} a_{n+2} = 4a_{n+1} - 4a_n, n \geq 0 \\ a_0 = 1, a_1 = 3 \end{cases}$$
4. (12%) Let $f: S \rightarrow T$, and $g: T \rightarrow U$. Then the composition function, $g \circ f$, is a function from S to U defined by $(g \circ f)(s) = g(f(s))$. Consider the following statements, which are false statement(s)?
 (a) If f is one-to-one then $f \circ g$ is one-to-one.
 (b) If f and g are onto then $f \circ g$ is onto.
 (c) If f and g are one-to-one and onto then $f \circ g$ is one-to-one and onto.
 (d) If $f \circ g$ is one-to-one then f is one-to-one.
 (e) If $f \circ g$ is one-to-one then g is one-to-one.
 (f) If $f \circ g$ is onto then f is onto.
 (g) If $f \circ g$ is onto then g is onto.
5. (12%) Please (1) design a minimum rail network connecting the seven cities, shown in the mileage chart below, (2) show sum of the network.

	City-1	City-2	City-3	City-4	City-5	City-6	City-7
City-1	0	500	400	600	100	550	300
City-2	500	0	620	1100	450	1000	700
City-3	400	620	0	525	520	900	420
City-4	600	1100	525	0	700	430	200
City-5	100	450	520	700	0	490	350
City-6	550	1000	900	430	490	0	330
City-7	300	700	420	200	350	330	0

(二)
「計算機數學與網路」科之「計算機網路概論」部份

- [10%] 1. (a) What is the main difference between TCP and UDP?
(b) Choose the following applications that are suitable to use UDP as the transport protocol rather than TCP?
ftp, email, Voice Over IP, Video On Demand, http.
- [10%] 2. If we use ftp to download files via wireless LAN (WLAN) access to Internet, sometimes we suffer large delay.
Can you explain at least 5 reasons for the large delay?
- [4%] 3. Many companies have a policy of having two (or more) routers connecting the company to the Internet to provide some redundancy in case one of them goes down. Is this policy still possible with NAT (Network Address Translation)? Explain your answer.
- [6%] 4. The wireless LANs used protocols such as CSMA/CA (or MACA) instead of using CSMA/CD. Under what conditions, if any, would it be possible to use CSMA/CD instead?
- [10%] 5. With the growth of multimedia applications, quality of service (QoS) is needed. Can you list at least 3 QoS requirements for these applications? Explain briefly the techniques for achieving good QoS in each requirement.