Tanta University

Department: **Production Engineering and design**
Total Marks: **85 Marks**

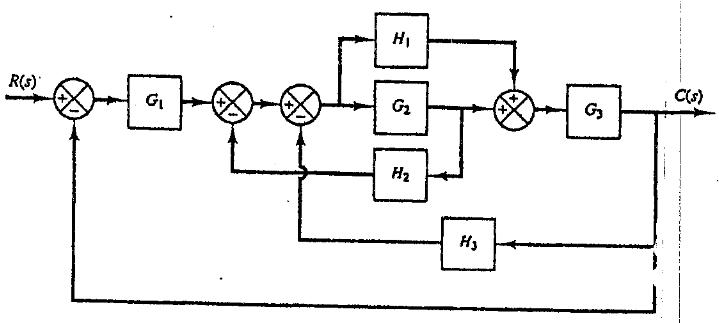
Faculty of Engineering

Course Title: **Automatic Control**	Course Code: **MPD3223**	Year: 3^{th} **Prod. Eng.Dept**
Date: **16- 05 - 2015 [Re-final]**	Allowed time: **1.5 Hrs**	No. of Pages: **(2)**

Answer All The Following Questions:- **{Each Question Carries "17" Marks}**

Question (1):-

Simplify the block diagram shown in the following figure and obtain the closed-loop transfer function C(s) / R(s).



Figure[Q.1] Block diagram of a system.

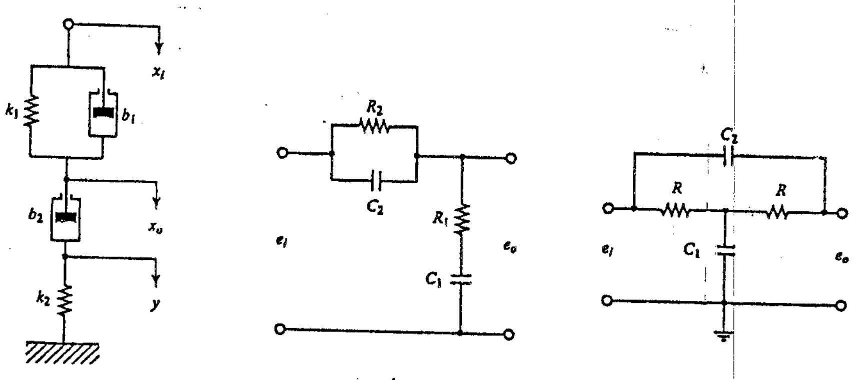
Question (2):

i- If the characteristic equation of a closed-loop control system is in the form:-

$$D^6 + 6D^5 + 37D^4 + 72D^3 + 327D^2 + 162D + 675 = 0$$

Determine the stability condition of this system by the use of Routh stability method.

ii-Obtain the transfer functions $X_o(s) / X_i(s)$ **of (a)** *and* $E_o(s) / E_i(s)$ **of the bridged T networks shown the following figures (b) and (c).**



(a) (b) (c)

Figure[Q.2] (a) Mechanical system and Bridged *T* Networks.

Question (3):

Use the block diagram of the control system shown in the following figure to find out the value of the controller gain (K) which makes the given system critically stable.

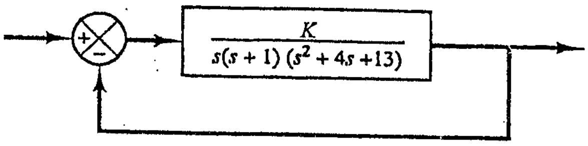


Fig.[Q. 3] Closed-loop Control System..

Question (4):- (17 Marks)

(a) A process plant consists of two tanks of capacitance C_1 and C_2. If the flow rate into the top tank is Q_3, **find** the transfer function relating this flow to the level in the bottom tank. Each tank has a resistance R in its outlet pipe. (Consider the tanks to be noninteracting.) (9 Marks)

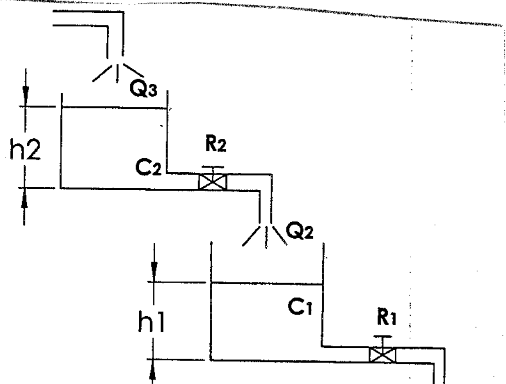


Figure of Question(4-a).

(b) For the shown valve, **derive** the overall transfer function ($\dot{q}_o/\dot{P}_i$). (8 Marks)

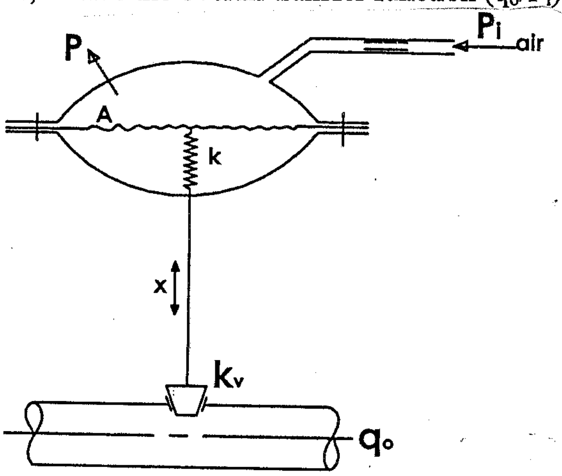


Figure of Question(4-b).

Question (5):- (17 Marks)

(a) **Apply** Nyquist criterion to examine the relative stability of the open-loop transfer function given in the form:-

$$GH = \frac{10}{(D+1)(D+2)}$$

(7 Marks)

(b) If the characteristic equation of a closed-loop control system is in the form:

$$S^6+6S^5+37S^4+72S^3+327S^2+162S+675=0.$$

Determine the stability condition of this system by use of Routh stability method. (10 Marks)

(انتهت الأسئلة)

With My Best Wishes

Tanta University
Faculty of Engineering
Dept. of Computer & Control Eng.
Subject: Artificial Intelligence

Date: 5/2015
Time allowed: 180 Min.
Full Mark: 100 Mark
Final Term Exam (2nd Semester)

Answer The Following Questions (ملحوظة هامة: الأسئلة في ورقتين)

The First Question

(a) Define **Artificial Intelligence.** Explain briefly the main ideas of **Alan Turing test.**

(b) Compare between **Strong AI** and **Weak AI.**

(c) The tower of Hanoi problem is defined as following: We have three pegs and a number of disks of different sizes as shown in Fig. 1. The aim is to move from the starting state where all the disks are on the first peg, in size order (smallest at the top) to the goal state where all the pegs are on the third peg, also in size order. We are allowed to move one disk at a time, as long as there are no disks on top of it, and as long as we do not move it on top of a peg that is smaller than it.

Draw the complete search tree of the above assuming that the starting state is represented as (1,2,3) () (), and the goal state is () () (1,2,3).

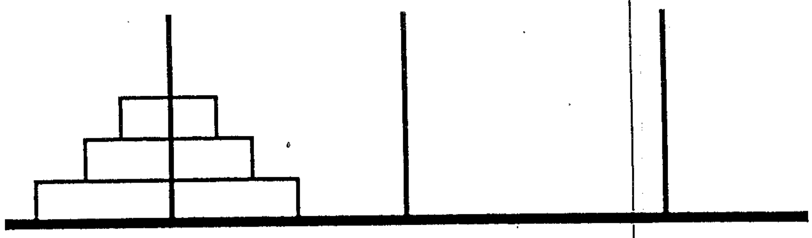


Fig.1. The tower of Hanoi problem

The Second Question

(a) Why are **representations** so important in Artificial Intelligence? What risks are inherent in using the wrong representation?

(b) Consider the following knowledge: "A Ford is a type of car. Bob owns two cars. Bob parks his car at home. His house is in California, which is a state. Sacramento is the state capital of California. Cars drive on the freeway, such as Route 101 and Highway 81".

1) Represent the above knowledge using **semantic** nets.
2) Represent the previous problem using **frame** representation.
3) Compare between semantic nets representation and frame representation.

(c) Design a suitable representation and draw the complete search tree for the following problem: A farmer is on one side of a river and wishes to cross the river with a wolf, a chicken, and a bag of grain. He can take only one item at a time in his boat with him. He can't leave the chicken alone with the grain, or it will eat the grain, and he can't leave the wolf alone with the chicken, or the wolf will eat the chicken. How does he get all three safely across to the other side?

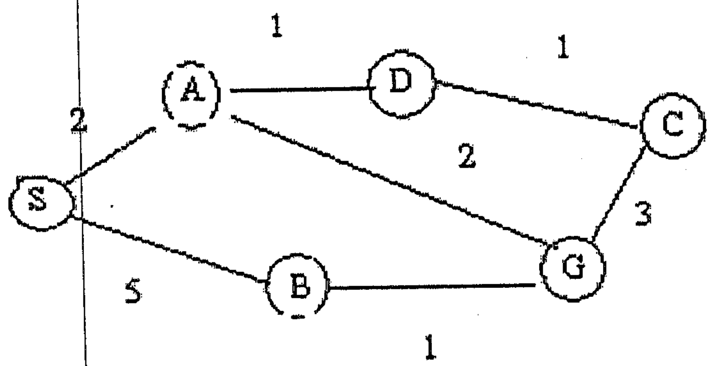
The Third Question

(a) Compare between the **depth-first and breadth-first search.**

(b) Answer by true or false.

1. Breadth first search is not optimal in case actions have different cost.
2. Greedy search is a special case of uniform cost search.
3. If uniform cost search is complete, it is also optimal.
4. If a heuristic function h() is admissible, greedy search is optimal.

(c) Given the following graph where S is the starting node and G is the goal node. Numbers related to arcs between nodes indicate step costs. Trace Graph-Search algorithm using **BFS** and **DFS** strategies. In each case, show the order in which nodes are added to the fringe as well as the generated tree and the solution path. Do not add a state as a leaf if that state is on the path from the root to the current node of the generated tree. Nodes are added to the tree in alphabetical order. Indicate if found solutions are optimal.

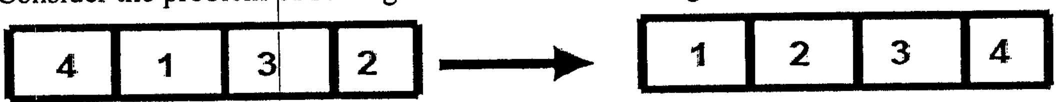


The Fourth Question

(a) Explain the idea behind **Generate** and **Test.** Why is this method described as being *exhaustive.*

(b) Consider a best first search algorithm in which the evaluation function f is given by:
$f(n) = (2 - x)g(n) + xh(n)$
1. Assuming that h(n) is admissible, for what values of x is this algorithm guaranteed to be optimal?
2. What kind of search does it perform when x = 0? When x = 1? When x = 2?

(c) Consider the problem of sorting numbers into ascending order:



- State representation: a sequence of four numbers
- Initial state: 4, 1, 3, 2.
- Goal state: 1, 2, 3, 4.
- Operators:
Swapleft: swaps leftmost numbers e.g., in the initial state, 4 and 1.
Swapmiddle: swaps numbers in the middle e.g., in the initial state, 1 and 3.
Swapright: swaps rightmost numbers e.g., in the initial state, 3 and 2.
Operators should be applied in this order: Swapleft, Swapmiddle, then Swapright.
- Path cost: number of swaps.

Apply A* search algorithm to find the minimum number of swaps required to sort the numbers. Draw the search tree, showing the nodes generated and their f-cost values. Show the content of the fringe (priority queue) at each step. The heuristic function that can be used is the Manhattan distance, the sum of the distances of the numbers from their correct locations. For instance, the heuristic value h(n) in the initial state is 3 + 1 + 0 + 2 = 6.

The Fifth Question

(a) What the difference between forward chaining and backward chaining. Explain the advantages and disadvantages of each method.

(b) What is the purpose of meta rules. Would an expert system have any advantages if it knew the difference between meta rules and normal rules.

(c) Draw a block diagram showing the architecture of an expert system.

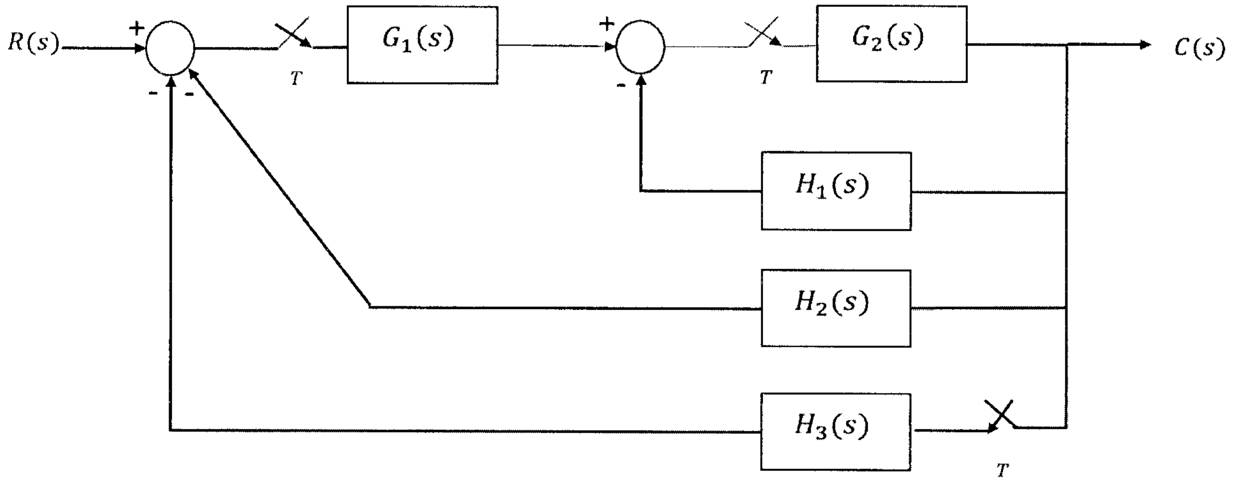
With my best wishes

Course Title: Digital Control	Course Code: CCE3220	Year: 3rd
Date: May 2015 (تخلفات)	Allowed time: 3 hrs	No. of Pages: (2)

Answer the following questions.

Problem number (1) (30 Marks)

(a) For the following block diagram, find, if it exists, the closed loop transfer function:



(b) Check the stability of the control systems having the following characteristic equations . using Jury test or bilinear transformation:

i. $Z^2 + Z - 2 = 0$

ii. $Z^3 - 1.8\,Z^2 - 1.05\,Z - 0.2 = 0$

Problem number (2) (40 Marks)

(a) A unity Feedback control system having the following open loop transfer function:

$$GH(z) = \frac{z}{(z-1)^2(z^2 - z + 1)}$$

i. Determine the closed loop transfer function
ii. What is the system type and degree of the system.
iii. Determine the system error constants
iv. Calculate the steady state error for unit step input
v. Calculate the steady state value of the output for unit step input

(b) For the system having the following open loop transfer function, Draw the Root Locus and find the value of K for critical stability.

$$GH(z) = \frac{K(z+0.2)}{z\,(z-1)}$$

Problem number (3) (50 Marks)

(a) For the control system having the following transfer function

$$T.F = \frac{Y(z)}{R(z)} = \frac{2z^2 + 3z + 4}{z^3 + 2z^2 - 3z + 2}$$

i. Obtain the corresponding discrete state space model in controllable and observable form.

ii. Draw the state diagram for each form.

(b) The state-space representation of a continuous system is given by:

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} x(t)$$

Find the corresponding discrete-time state-space matrices (A_d, B_d, C_d) when a sampler with T=1Sec and ZOH circuits are used.

(c) The state-space representation of a continuous system is given by:

$$x(k+1) = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} x(k) + \begin{bmatrix} 2 \\ 2 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 1 & 0 \end{bmatrix} x(k)$$

i. Check the system controllability and observability.

ii. Find the closed loop transfer function of the system.

iii. Using pole-placement design, find the gain matrix K that yields the closed loop poles locate at $Z_{1,2} = 0.528 \pm j0.295$

Good luck

Dr. M. Arafa

Tables of RC cross sections design [Working Stresses Design Method]

Allowable working stresses for concrete (kg/cm^2)

Characteristic strength	F_{cu}	150	175	200	225	250	275	300
Axial Compression	f_{co}	40	45	50	55	60	65	70
Beams (binding)	f_c	65	70	80	90	95	100	105
Shear (beams without RFT)	q_c	5	5	6	6	7	7	7

Allowable working stresses for steel types

Steel type	Mild steel 24/35	Steel 28/45	Steel 36/52	Steel 40/60
f_s (kg/cm^2)	1400	1600	2000	2200

Table of K_1 & K_2 for f_s = 2000 kg/cm^2

f_c	α= 0.0		α= 0.2		α= 0.4		α= 0.6		α= 0.8		α= 1.00	
	k_1	k_2	k_1	k_2	k_1	k_2	k_1	k_2	k_1	k_2	k_1	k_2
20	.897	1913	.896	1912	.891	1912	.888	1911	.885	1910	.882	1909
25	.731	1894	.726	1893	.722	1891	.717	1890	.712	1889	.707	1888
30	.621	1877	.615	1876	.609	1874	.602	1873	.596	1871	.590	1869
35	.542	1862	.536	1860	.529	1859	.521	1857	.514	1855	.507	1853
40	.484	1846	.476	1845	.468	1843	.460	1841	.451	1840	.443	1835
45	.438	1832	.429	1831	.421	1829	.411	1828	.402	1827	.392	1826
50	.401	1818	.389	1816	.382	1817	.372	1815	.362	1815	.351	1814
55	.371	1806	.361	1806	.350	1805	.339	1805	.329	1805	.317	1805
60	.347	1793	.335	1793	.325	1794	.312	1794	.300	1794	.288	1795
65	.324	1782	.313	1783	.302	1784	.289	1785	.277	1787	.264	1788
70	.306	1771	.294	1773	.282	1775	.269	1777	.256	1779	.242	1782
75	.289	1761	.277	1763	.265	1766	.251	1769	.237	1773	.222	1776
80	.276	1750	.263	1754	.250	1759	.236	1763	.221	1767	.205	1772
85	.263	1740	.250	1748	.236	1751	.222	1753	.206	1762	.189	1768
90	.250	1731	.239	1738	.226	1745	.209	1752	.193	1759	.175	1766
95	.243	1722	.229	1730	.214	1739	.198	1747	.181	1755	.162	1765
100	.233	1715	.219	1724	.205	1735	.188	1744	.170	1753	.150	1763

. For Simple Bending : $d = k_1\sqrt{\frac{M}{b}}$, $A_s = \frac{M}{k_2 \cdot d}$;

Table of steel bars

Φ mm	weight kg/m	Area of Cross-Section in cm^2									
		1	2	3	4	5	6	7	8	9	10
6	.222	.283	.566	.848	1.13	1.41	1.70	1.98	2.26	2.54	2.83
8	.395	.503	1.01	1.51	2.01	2.51	3.02	3.52	4.02	4.52	5.03
10	.617	.785	1.57	2.36	3.14	3.93	4.71	5.50	6.28	7.07	7.85
13	1.04	1.33	2.66	3.98	5.31	6.64	7.96	9.29	10.6	11.9	13.3
16	1.58	2.01	4.02	6.03	8.04	10.1	12.1	14.1	16.1	18.1	20.1
19	2.23	2.835	5.67	8.50	11.3	14.2	17.0	19.9	22.7	25.5	28.4
22	2.98	3.80	7.60	11.4	15.2	19.0	22.8	26.6	30.4	34.2	38.0
25	3.85	4.91	9.82	14.7	19.6	24.5	29.5	34.4	39.3	44.2	49.1
28	4.83	6.16	12.3	18.5	24.6	30.8	37.0	43.1	49.3	55.4	61.6
32	6.31	8.04	16.1	24.1	32.2	40.2	48.3	56.3	64.3	72.4	80.4
38	8.90	11.3	22.6	33.9	45.2	56.5	67.8	79.1	90.4	102	113