EGCO 333 Computer Architectures (2/2561)

SO1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Passing criterion >= 50%

PI 1-1 Identify and formulate engineering problems

PI 1-2 Solve problems by applying mathematics and engineering knowledge

==========

SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Passing criterion >= 50%

PI 7-1 Acquire and apply new knowledge

PI 7-2 Use appropriate sources of knowledge

==========

PI 1-1 Identify and formulate engineering problems

Quiz 1

(14 marks) 1. A chemical plant needs a control system that can control 7 sub-processes (called A B C D E F G respectively) that must work in a specific predetermined order. After a start button has been pushed, these 7 sub-processes will repeat themselves for 4 times, i.e. A B C D E F G (1st) .. A B C D E F G (4th). Show how to design a control system that can control the 7 sub-processes (9 marks). And explain the idea of how to make the 7 sub-processes repeat for 4 times (5 marks).

Midterm Exam

(14 marks) 4. Both integers and floating point numbers are used in engineering computation. 2's complement system can be used to represent signed integer numbers. Whereas IEEE754 is used as a technical standard to represent floating point numbers to make data migration between systems smooth. Assume that a computer uses 32 bits to represent floating point number as follows (not IEEE754 standard),

- sign bit of number is 1 bit
- (sign-magnitude) exponent size is 9 bits (including sign-bit)
- normalized fraction (0.1xxx...) of size 22 bits

(A) (3 marks) show frame format and explain the meaning of each fields

(B) (6 marks) show how -29.75_{10} is represented as explained in (A) (provides a space after every 4 bits)

(C) (5 marks) show and explain the meaning of positive underflow

PI 1-2 Solve problems by applying mathematics and engineering knowledge

Final Exam

(15 marks) 7. The following variables are declared within a program, int A[1024], B[1024], C[11024] and are allocated memory space as shown in the figure below. Explain whether efficiencies (cache related **only**) of the computer system using direct mapping cache differs from the one using associative cache.

PI 7-1 Acquire and apply new knowledge

Midterm Exam

(10 marks) 5. Normally, an n x 2^n MUX can be used to construct an output of any n-input variable combinational circuit. Explain and show how to construct a 1-bit full adder from two 3x8 MUXs where A, B and Cin are inputs and SUM and Cout are outputs.

PI 7-2 Use appropriate sources of knowledge

Final Exam

(20 marks) 2. Assume delay time of AND, OR and EX-OR gates are x, x and 2x respectively. N of 1-bit adders (each has a total working delay time 4x, top figure) connected as a carry ripple adder can be used to construct an n-bit adder (bottom figure). Explain concept and show how to design a circuit that can work (i.e. add) faster. (*hint: fast or carry lookahead adder*)

Student Number	SO1			SO7	
	PI 1-1		PI 1-2	PI 7-1	PI 7-2
	Qz 1 Prob 1	Midterm Prob 4	Final Prob 7	Midterm Prob 5	Final Prob 2
1	3.0	5.0	3.0	8.0	2.0
2	6.5	4.0	8.0	0.0	2.0
3	4.0	5.0	7.0	0.0	5.0
4	3.0	12.0	4.0	2.0	2.0
5	8.5	7.0	9.0	1.0	2.0
6	2.0	12.0	12.0	2.0	0.0
7	10.5	12.0	5.0	2.0	5.0
8	2.0	8.0	6.0	0.0	5.0
9	9.0	10.0	5.0	4.0	2.0
10	1.0	0.0	3.0	0.0	2.0
11	2.0	5.0	12.0	0.0	0.0
12	1.0	2.0	7.0	1.0	6.0
13	2.0	5.0	5.0	2.0	5.0
14	1.0	13.0	10.0	1.0	2.0
15	-	9.0	4.0	10.0	3.0
16	4.0	10.0	4.0	2.0	2.0
17	2.0	4.0	9.0	2.0	6.0
18	6.0	6.0	11.0	2.0	3.0
19	2.5	9.0	9.0	2.0	5.0
20	2.5	5.0	9.0	1.0	18.0
21	4.5	14.0	12.0	10.0	2.0
22	2.0	7.0	9.0	2.0	3.0
23	1.0	8.0	8.0	2.0	2.0
24	2.0	14.0	7.0	6.0	4.0
25	3.5	13.0	6.0	3.0	12.0
26	11.0	14.0	6.0	7.0	5.0
27	2.0	14.0	4.0	10.0	12.0
28	6.5	10.0	4.0	3.0	5.0
29	5.0	6.0	10.0	8.0	12.0
30	2.0	9.0	8.0	8.0	2.0
31	2.0	14.0	4.0	2.0	2.0
32	2.0	6.0	8.0	9.0	0.0
33	1.0	12.0	6.0	8.0	2.0
34	4.5	14.0	12.0	9.0	20.0
Mean	3.68	8.76	7.24	3.79	4.71

PART A : Expected Outcomes and Assessment

Course Objectives	Student Outcome (SOs)	Direct & Assessment*	Assessment ** Results
1. Provide students with general design methodology of computer's major components (e.g. adding, subtracting, multiplying, and division algorithms and circuits), data representation, control unit design, leading to a computer architecture.	1	Quiz 1 Prob 1: (>50%) Midterm Prob 4: (>50%)	12% (4/34) 65% (22/34)
		Average percentage	48.82%
2. Provide students with basic knowledge for improving performance of computer system using pipeline and cache memory.	1	Final Prob 7: (>50%)	47% (16/34)
		Average percentage	47.06%
3. Allow students to see different implementations (of hardware circuits) that offer different costs and performances.	7	Midterm Prob 5 : (>50%) Final Prob 2: (>50%)	32% (11/34) 15% (5/34)
		Average percentage	23.53%

Summary: **SO 1's result: (48.82+47.06)/2 = 47.94**

SO 7's result: 23.53

SO1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Passing criterion >= 50%

PI 1-1 Identify and formulate engineering problems

PI 1-1 Quiz1 Prob1: Attainability = 4/34 = 12% **Not Attainable**

PI 1-1 Mid Prob4: Attainability = 22/34 = 65% **Attainable**

Average = 48.82% **Not Attainable**

PI 1-2 Solve problems by applying mathematics and engineering knowledge

PI 1-2 Fin Prob7: Attainability = 16/34 = 47.06% **Not Attainable**

SO1 Conclusion

PI	Attainability	Reason	Remedial Action	Action plan	Measurements
1-1	✘	Students do not understand sequential circuit design well enough (quiz1).	Have students do more circuit design exercises start from intermediate to difficult design.	Next semester	Next semester
1-2	✘	Students cannot apply learning knowledge.	Provide more examples or use different examples.	Next semester	Next semester

SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Passing criterion >= 50%

PI 7-1 Acquire and apply new knowledge

PI 7-1 Mid Prob5: Attainability = 11/34 = 32% **Not Attainable**

PI 7-2 Use appropriate sources of knowledge

PI 7-2 Fin Prob2: Attainability = 5/34 = 15% **Not Attainable**

SO7 Conclusion

PI	Attainability	Reason	Remedial Action	Action plan	Measurements
7-1	✘	Students cannot apply learning knowledge.	Use different explanation.	Next semester	Next semester
7-2	✘	Students cannot understand and apply learning knowledge.	Use more examples.	Next semester	Next semester