NT Summer
MAS4203 4801

**Class-A**

Prof. JLF King
Wednesday, 17Feb2016

**A1:** *Show no work.*

a) Cubic polynomial $h(x) := [x+5][x-11][x+37]$ has $K$ many roots in $\mathbb{Z}_8$, and $N$ many roots in $\mathbb{Z}_{120}$, where $K$= ______ and $N$= ______. [*Hint:* CRT.]

b) Euler $\varphi(36300) = 2^A \cdot 3^B \cdot 5^C \cdot 7^D \cdot 11^E$, where $A$= ____, $B$= ____, $C$= ____, $D$= ____, $E$= ____.

As a single number, $\tau(36300)$ = ______.

c) Fix a prime $q$ and natnums $J$ and $R$. Then a closed-formula for $\sigma_J$ is: $\sigma_J(q^R)$ = ______.

Apply the [correct] CF; leave your answer as a product: $\sigma_2(140)$= ______

d) The ***Blip-numbers*** comprise $\mathcal{B} := 1 + 3\mathbb{N}$.

$\mathcal{B}$-number $385 \overset{\text{note}}{=\!=} 35 \cdot 11$ is $\mathcal{B}$-*irreducible*: *T* *F*

$\mathcal{B}$-number $N := 85$ is **not** $\mathcal{B}$-*prime* because $\mathcal{B}$-numbers $J$:= ______ and $K$:= ______ satisfy that $N \bullet\!| [J \cdot K]$, **yet** $N \nmid J$ and $N \nmid K$.

e) Multinomial coefficient $\binom{9}{4,2,3}$ = ______ = ______.

[*Note:* Write your ans. ITOf factorials, then **also** write it as a single integer, or product of two, **without** factorials.]

OYOP: *In grammatical English* ***sentences****, write your essays on every* ***third*** *line* (usually)*, so that I can easily write between the lines. Start each essay on a* ***new*** *sheet of paper.*

**A2:** State Wilson's Thm. Carefully prove Wilson's Thm.

*More on next page...*

**A3:** Let $T_d := 18^d + 1$ for $d = 3, 5, 7, 9, 11, \ldots$. Prove that each such $T_d$ is composite.

[*Hint:* Look at $T_{\text{Odd}}$ mod-$N$, for an appropriate $N$.]

End of Class-A

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|---|---|---|
| **A1:** | ___ ___ ___ | 125pts |
| **A2:** | ___ ___ | 45pts |
| **A3:** | ___ ___ | 35pts |
| **Total:** | ___ ___ ___ | 205pts |